



INDIANA DEPARTMENT OF TRANSPORTATION

**Request to move the SR 46 Bridge over the Eel River
Bridge No. 046-11-01316C
from Clay County, Indiana to Brown County, Indiana**

Related to INDOT Des. No. 0800910

**Prepared per 36 CFR § 60.14 (b)(1)
by INDOT Cultural Resources Office staff
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May 2015



Introduction

Per 36 CFR § 60.14 (b)(1), properties listed in the National Register of Historic Places (National Register) should be moved only when there is no feasible alternative for preservation. Additionally, when a property is moved, every effort should be made to reestablish its historic orientation, immediate setting, and general environment.

As part of the Indiana Department of Transportation (INDOT)'s project Des. No. 0800910, with funding provided by the Federal Highway Administration (FHWA), INDOT has identified a preferred alternative that calls for dismantling and moving the two spans of the National Register-listed State Bridge No. 046-11-01316C from its existing location in Clay County to two new locations along a trail in Brown County, Indiana.

Per 36 CFR § 60.14 (b)(2), if it is proposed that a property listed in the National Register be moved and the State Historic Preservation Officer (SHPO) wishes the property to remain in the National Register during and after the move, the SHPO shall submit documentation to the National Park Service (NPS) prior to the move. Also, per 36 CFR § 60.14 (b)(3), any such proposal with respect to the new location shall follow the required notification procedures, shall be approved by the State Historic Preservation Review Board (Review Board) if it is a State nomination and shall continue to follow normal review procedures. The Keeper of the National Register (Keeper) shall also follow the required notification procedures for nominations. The Keeper shall respond to a properly documented request within 45 days of receipt from the SHPO.

In a letter to INDOT's consultant, Parsons Transportation Group (Parsons), dated March 5, 2015, the SHPO stated that if Bridge No. 046-11-01316C must be moved, "then we would want it to remain listed during and after the move if at all possible." As such, INDOT has prepared the following information to aid in the Indiana SHPO's required documentation submittal to the Review Board and Keeper in order for Bridge No. 046-11-01316C to remain in the National Register during and after the move.

Reasons for the proposed move of Bridge No. 046-11-01316C - per 36 CFR § 60.14 (b)(2)(i)

Bridge No. 046-11-01316C was listed in the National Register National Register in 2000. As part of the *Indiana Historic Bridge Inventory*, the bridge was determined to be Select. Select bridges are historic bridges that are most suitable for preservation and are excellent examples of a given type of historic bridge. The Individual Review conducted for the bridge as part of the *Inventory* process specifically designated the bridge "Select for Non-Vehicular Use," indicating it is better suited for bicycle and/or pedestrian use than for vehicles.

Major rehabilitation work is needed on Bridge No. 046-11-01316C at this time because nearly all steel members show some amount of rusting and/or minor section loss and the lower portion of all sway bracing has been removed due to continued collision damage. The deteriorated condition of the superstructure has required two closures of the bridge in recent years. In 2011 the bridge was closed to traffic requiring INDOT to complete repair work to some gusset plates and floor beams. In 2012 it was closed again after in-depth inspections revealed additional concerns. Additional gusset plate repairs were undertaken to reopen the bridge.

A detailed alternatives analysis for this bridge summarizing the bridge's existing conditions and exploring rehabilitation/re-use options was prepared by INDOT's consultant (Parsons, 5-21-15). A summary is provided below. The full text of the alternatives analysis can be found in Appendix A. The appendices of

the alternatives analysis are not included since they are over 450 pages long, but they are available upon request.

Despite its Select designation for Non-Vehicular Use, INDOT nonetheless examined the rehabilitation option to keep the bridge in continued vehicular use. This alternative would be expected to extend the life of the structure by approximately 25 years and would undertake the following work:

- Replacement of
 - Approximately 80% of lower chord members;
 - All gusset plates at the end bents and center pier;
 - Approximately 50% of other gusset plates;
 - Approximately 75% of splice plates, cover plates, and batten plates;
 - Approximately 50% of the lower lateral cross bracing and corner support angles;
 - Approximately 25% of vertical members;
 - Floor beams at each end bent and pier;
 - Existing bridge deck;
 - All bridge railing;
 - Rivets with round-headed bolts where members are replaced;
 - Exterior stringers (once the deck is removed additional stringers may be identified for replacement);
- Reinstallation of portal and sway bracing;
- Cleaning and painting of the entire bridge; and
- Patching of concrete on the abutments and center pier.

This alternative would be designed to meet “3R” (Resurfacing, Restoration, and Rehabilitation) standards as defined in the *Indiana Design Manual*. Due to the nature of truss bridges, it is not possible to address deficiencies related to the width of the structure without completely reconstructing the bridge. As such, design exceptions for lane, shoulder, and clear roadway width would be required. The bridge was originally designed with an H-20 structural capacity (20-ton truck) and the rehabilitation would restore this capacity. However, current design standards require accommodation for HS- 20 structural capacity (36 ton truck); therefore, this alternative would require a Level 1 design exception from INDOT and FHWA. Based on this bridge’s location on a National Truck Route and the number of heavy trucks known to use the bridge, INDOT and FHWA have indicated that this design exception would not be approved. Therefore, this is not a prudent and feasible alternative.

The alternative to construct a new bridge parallel to the existing bridge and rehabilitate the existing bridge, with each structure carrying a single lane of traffic, was examined. This alternative includes constructing a new bridge approximately 20’ to the south of the existing structure to carry eastbound traffic, retaining westbound traffic on the existing structure. The new bridge would be constructed to accommodate future 2-way travel, for the time when the existing bridge can no longer be maintained. The existing bridge would be rehabilitated in the same way described above with the same service life expectations. It would also have the same structural capacity limitations and would still require a Level 1 design exception. Additionally, this alternative is very costly. Therefore, this is not a prudent and feasible alternative.

INDOT is proposing to dismantle and move the two spans of the bridge from its existing location in Clay County to two new locations along a trail in Brown County, Indiana. The existing bridge would be relocated and rehabilitated for use on the Salt Creek Trail, a 2.5-mile multi-use trail connecting Nashville to Brown County State Park (BCSP), two heavily visited tourist destinations. The purpose of the trail project is to provide an alternative transportation mode for pedestrians that are currently using SR 46 to

travel to land uses in and between Nashville and BCSP. The conflict between pedestrians and the motoring public is currently unsafe. The trail will reduce traffic congestion between the County's three largest motels and the shops in Nashville by providing pedestrian access rather than visitors driving to the shopping areas. In addition, the trail will provide a safe means of transportation for the youth of Nashville and Brown County as it will connect the Brown County School Corporation sports facilities. The trail has been under development for several years, with construction of the first phase already underway. The project includes two crossings of Salt Creek, approximately 0.7 mile apart from one another. The two spans of the existing bridge would be separated to cross Salt Creek at these two locations.

The option of keeping the bridge in place at or near its original location in Clay County as a pedestrian structure and bypassing it with a new bridge was explored. This alternative was dismissed based on the location of the bridge in a sparsely populated area. A sidewalk or multi-use path could be provided from the nearby unincorporated town of Bowling Green to the bridge. The town is located approximately 0.25 mile to the east of the existing bridge with a population of approximately 250. Although it is the closest population center, Bowling Green does not commonly draw visitors from other areas. In 2009, INDOT reached out to Clay County regarding the possibility of relocating the bridge immediately adjacent to the existing location so that the County could create a park with the bridge as a feature. Clay County indicated that they had no interest in creating a park facility utilizing the bridge.

At a December 4, 2014 meeting with Consulting Parties, a request was made to INDOT to conduct outreach to Clay County and the public to determine the level of interest in retaining the bridge in its current location. On January 29, 2015, INDOT held a public meeting in Bowling Green to provide an overview of the project, including the bridge's condition, the alternatives under consideration, and the potential to relocate the bridge to Brown County. The deadline for a local party to step forward and take responsibility for the bridge was originally set as March 30, 2015; however, based on comments received at the meeting and during the comment period, INDOT extended this deadline to the time of the public hearing, currently anticipated for the first week of August 2015, a period of more than six months from the date of the public meeting. To date, no parties have stepped forward to take responsibility for the structure and retain it in place.

INDOT believes that the pedestrian usage of the existing bridge in its current location would be minimal and provide little value to the general public as a historic site compared to its potential use at other locations. At the Salt Creek Trail location, there is a strong demand for a pedestrian facility. When complete, it is anticipated that approximately 10,000 people will use the trail each year. It is anticipated that on the Salt Creek Trail, the span to be located adjacent to SR 46 at Eagle Park would be owned and maintained by Brown County, while the span located within BSCP would be owned and maintained by DNR. Each party will be required to sign an agreement committing to maintain their respective structures for a minimum of 25 years. However, it is anticipated that, based on the expected visitation levels, the bridges would be retained far beyond that minimum. DNR and Brown County have each submitted a letter of intent to take responsibility for the bridge spans.

It should also be noted that an approach that would keep the two spans together as part of the Salt Creek Trail was evaluated; however, the topography, hydraulic conditions, and presence of wetlands in the area, make that option impractical. Preliminary investigations confirmed that using the spans at two separate locations was the only practical option.

Effect of the move on Bridge No. 046-11-01316C's historical integrity - per 36 CFR § 60.14 (b)(2)(ii)

Given the decreased loading associated with pedestrian use, the extent of rehabilitation of Bridge No. 046-11-01316C for use on the Salt Creek Trail would not be quite as extensive as required for vehicular

use. The scope of the rehabilitation described here is based on visual inspection and engineering judgment only and includes:

- Replacement of:
 - Approximately 25% of lower chord members;
 - All gusset plates at the end bents and center pier;
 - Approximately 50% of other gusset plates;
 - Approximately 25% of splice plates, cover plates, and batten plates;
 - Approximately 10% of the lower lateral cross bracing and corner support angles;
 - Approximately 10% of vertical members;
 - Floor beams at each end bent and pier;
 - Existing bridge deck;
 - All bridge railing;
 - Rivets with round-headed bolts where members are replaced;
 - Exterior stringers (once the deck is removed additional stringers may be identified for replacement);
- Reinstallation of portal and sway bracing;
- Cleaning and painting of the entire bridge;
- Construction of new abutments at the new bridge locations;
- Construction of ADA compliant shared-use trail approaches to the bridges that connect to the existing ground elevation.

No formal determination has been made as to whether the improvements described above would meet the *Secretary of the Interior's Standards for Rehabilitation (Secretary's Standards)*. However, it is anticipated that structural materials would be replaced in-kind and the integrity of the truss would be retained. Rivets would be replaced with round-headed bolts to retain visual similarity and missing sway bracing would be re-installed. In accordance with Attachment B of the *Programmatic Agreement among the Federal Highway Administration, the Indiana Department of Transportation, the Indiana State Historic Preservation Officer, and the Advisory Council on Historic Preservation Regarding Management and Preservation of Indiana's Historic Bridges (Historic Bridge PA)*¹, the rehabilitation plans will be reviewed by the Indiana SHPO to ensure compliance with the *Secretary's Standards* and to incorporate context sensitive design features, where practicable.

With regard to relocating the bridge, INDOT shall disassemble the bridge while match-marking and mapping its components. The disassembly will be conducted as non-destructively as possible and shall incorporate principles and guidance (as feasible and relevant to bridges) from the publication "Moving Historic Buildings" by John Obed Curtis (published originally by the United States Department of the Interior). If the bridge must be stored before reassembly at the new locations, the larger components shall be placed on blocks or railroad tie and stored off the ground. Smaller components and other detached members shall be stored indoors or in an otherwise locked facility. As has successfully occurred with several other bridge projects in the past, INDOT will submit the detailed disassembly plan to the Indiana SHPO and FHWA for review and approval before disassembly shall take place.

Even though the trusses will be separated at the new locations on the Salt Creek Trail, the trusses are structurally independent and once reassembled and rehabilitated, each truss will retain its historical and evolutionary integrity/significance as examples of Indiana State Highway Commission (ISHC)-designed Parker through trusses.

¹ The Historic Bridge PA can be downloaded here: <http://www.in.gov/indot/files/HistoricBridgePA.pdf>.

New setting and general environment of the proposed site - per 36 CFR § 60.14 (b)(2)(iii)

The current setting of Bridge No. 046-11-01316C is on SR 46 over the Eel River, approximately 4.84 miles east of SR 59, in Clay County. SR 46 is functionally classified as a Rural Minor Arterial on Indiana's 3R system. The speed limit across the structure and on SR 46 west of the bridge is 55 mph, but it is reduced east of the bridge as SR 46 nears the small town of Bowling Green. Specifically, this bridge is located in Sections 13 & 24 of Township 11 North, Range 6 West and Sections 19 of Township 11 North, Range 5. This location is in Washington Township in Clay County, which can be seen on the USGS Center Point Quadrangle Map.

The Eel River is a perennial stream and exhibits an ordinary high-water mark (OHWM). It is listed on the "Roster of Indiana Waters Declared Navigable or Non-navigable" as a navigable stream. Three other bodies of water are within the project area, though they are not shown on the USGS topographic map. Stream 1 is an unnamed tributary (UNT) to the Eel River, and is located in the southeast quadrant of the project area. Stream 1 is an ephemeral stream that exhibits an OHWM, and has a confluence with the Eel River just downstream of the project area. Streams 2 and 3 are both unnamed tributaries to Stream 1. They are both ephemeral streams with an OHWM, located in the southeast quadrant of the project area.

The land in the northwest and southwest quadrants is primarily used for row-crop agriculture while the eastern quadrants are primarily forested. Terrestrial habitat in the project area primarily consists of the forests east of the river, a narrow wooded riparian corridor along the west bank of the river, grassy roadside, and the farmland. The project area supports a variety of flora and fauna typical to these habitats

The proposed new setting of Bridge No. 046-11-01316C is in rural Brown County, between the small town of Nashville, Indiana and the BCSP. Specifically, the new location is located in Sections 20 and 29, Township 9N, Range 3E. This location is in Washington Township in Brown County, which can be seen on the USGS Nashville Quadrangle Map. Salt Creek meanders through the project vicinity and is crossed by SR 46 three times between the project area and Nashville. There are currently no pedestrian facilities that cross Salt Creek, although Phase 1 of the Salt Creek Trail Project is now open from the south side of Nashville (near the CVS Pharmacy), east along Salt Creek to near the Brown County YMCA at the end of Hawthorne Drive.

Within the local community surrounding the project area, this creek is simply called Salt Creek, but the full name of this watercourse is actually North Fork of Salt Creek. There are several streams in the area with "Salt Creek" in the name (North Fork, Middle Fork, South Fork, Little Fork, etc). All of these creeks merge in what is now Monroe Lake. The outflow of Monroe Lake is actually called just "Salt Creek."

Within the project area, the North Fork of Salt Creek is a perennial stream and exhibits an OHWM. It is listed on the "Roster of Indiana Waters Declared Navigable or Non-navigable" as a navigable stream from its junction with Salt Creek for 36.7 river miles to its junction with David Branch (which is near the SR 46/SR135 junction, 1.5 miles upstream from the project area).

At the proposed West bridge location, the west abutment would be on residential and commercial property. The east abutment would be in a wooded riparian corridor along Salt Creek on property that is owned by the Brown County School Corporation that is known as Eagle Park. At the proposed East bridge location, the north abutment would be in a wooded area consisting of floodplain forest. The south abutment would be in a grassy-covered lawn area adjacent to the BCSP pool parking lot. Terrestrial habitat in the project area primarily consists of floodplain forest, a narrow, wooded riparian corridor along

Salt Creek, and grassy lawns. The project area supports a variety of flora and fauna typical to these habitats.

Every effort would be made to reestablish the bridge's historic orientation, immediate setting, and general environment after the move. At its existing location, Bridge No. 046-11-01316C crosses the Eel River at in a general east-west alignment (on a slight diagonal). At the proposed West bridge location, the span would also be generally east-west oriented (on a diagonal). At the proposed East bridge location, the alignment of the span would generally be north-south due to the general east-west route of Salt Creek in this area, the desire to connect the trail near existing facilities in BCSP, and constraints related to topography and hydraulic conditions.

The bridge's existing conditions and immediate setting of forested land, a wooded riparian corridor, and grassy areas would be similar at both of the proposed new span locations. Additionally, at both the existing and new locations, the structure will span a navigable stream with several other small streams located in the greater area. Although miles from the existing location, the proposed new bridge locations would also be in proximity to the alignment of the roadway that the bridge currently carries, SR 46. While the commercial and residential property near the West bridge location and BCSP near the East bridge location are slightly different features than found at the existing location, they are not completely out of context. The outskirts of the town of Bowling Green, located approximately 0.25 mile east of the existing bridge, are visible when looking eastward from the bridge. Namely the large billboard that outlines the history of Bowling Green is discernible year-round while some buildings are discernible when foliage is off the trees.

The compatibility of the new site to the resource is ideal. At the proposed new locations, the bridge's historic orientation will be reestablished for one of the spans and for both of the spans, the immediate setting, and general environment will be reestablished. The fact that the spans can be placed across another navigable stream amidst similar flora and fauna and in proximity to the route that the bridge historically carried is a unique and desirable opportunity.

It should be noted that the proposed site does not possess historical or archeological significance that would be adversely affected by the relocation of Bridge No. 046-11-01316C. The new locations have been subjected to the appropriate archaeological and above-ground studies for compliance with Section 106 of the National Historic Preservation Act of 1966, as amended. A *Phase Ia Archaeological Survey Report* (Schwarz, 11/26/14) for the new sites of the bridge was prepared and determined that three archaeological sites within the Area of Potential Effects (APE) do not appear to be eligible for the National Register. The SHPO agreed with this recommendation in a letter dated December 15, 2014. The historic properties report for the proposed new locations (Nelson, 10/27/14) recommended two properties located within the APE, the Ramp Creek Covered Bridge and the BCSP North Gate House, as being eligible for the National Register, both under Criteria A and C. The SHPO issued a letter on December 22, 2014 concurring with the recommendations of the report. No adverse effects on these properties are anticipated as a result of the bridge relocation as both properties are located over 750' away from the location of the closest span with some trees and buildings partially blocking the view.

Justification for National Register Eligibility Under Criterion C During and After the Move

As mentioned above, even though it is necessary to separate the trusses at the new location on the Salt Creek Trail, the trusses are structurally independent. The ISHC utilized a varied number of spans of Parker trusses as the conditions of a specific crossing dictated. Examples ranged from one single span to nine spans at one location. Once reassembled and rehabilitated, each truss of Bridge No. 046-11-01316C

will retain its historical and evolutionary integrity/significance as an example of ISHC-designed Parker through trusses.

The relocation of the bridge would remove its association from events and historical patterns related to its original location and era. Therefore, it seems likely that it would only be considered eligible for inclusion in the National Register under Criterion C and no longer under Criterion A. Criterion C is applicable to structures that embody the distinctive characteristics of a type, period, or method of construction. Although originally listed in the National Register under Criterion A only, INDOT has prepared information to justify the bridge's listing under Criterion C as well at the state level. The bridge's Criterion C significance lies in being an important example of a revised, third-generation ISHC standard plan and an excellent and rare extant example of the work of a major Indiana bridge-building firm, the Vincennes Bridge Company.

In its new location, Bridge No. 046-11-01316C would still be an excellent example of an important ISHC standard plan. Common truss lengths for Parkers designed by the ISHC were 150', 175', and 200'. Therefore, even when functioning as two separate 198' trusses, they will still be two of the longer extant examples of an ISHC Parker truss. Additionally, the trusses will still be rare extant examples of Parkers built by the Vincennes Bridge Company. Due to relocation, the bridge spans' significance would be limited to the original date of construction, 1935.

Under National Register Criteria Consideration B, a property removed from its original or historically significant location can be eligible if it is significant for architectural value, or perhaps more appropriately in the case of a bridge, engineering value. Additionally, moved properties must still have an orientation, setting, and general environment that are comparable to those of the historic location and that are compatible with the property's significance. As explained above, the bridge will still retain significance under Criterion C and its new location is comparable to its original location and compatible with the bridge's significance. In its new location, the bridge will maintain its integrity of design, materials, workmanship, and feeling as an ISHC-designed and Vincennes Bridge Company-built Parker through truss.

Finally, it might be helpful to take into consideration the argument of noted Indiana bridge historian James L. Cooper that metal truss bridges are still significant after being moved, which was made in his July 2004 paper titled "Nomads of the Roadways: Metal Bridges on the Move." Even though written in the context of type of effects under Section 106 and not specifically related to National Register criteria, Cooper explains that metal bridges have traditionally been treated as "eminently moveable resources" and that their ability to be transported from one location to another is an "inherent and desirable characteristic." Specifically with regard to ISHC bridges, Cooper states that some of the once-prevalent standard designs no longer exhibit any extant examples on Indiana roadways and others are now "close to extinction." Therefore, he argues, "relocated examples of state-design may be our best hope for retaining elements of ISHC's trajectory on Hoosier highways."

Appendix A

Excerpt from Alternatives Analysis Document

HISTORIC BRIDGE ALTERNATIVES ANALYSIS

Bridge Number: 046-11-01316C

Designation Number: 0800910

SR 46 OVER EEL RIVER

Clay County

NBI Number: 017050

Eel River, 4.84 miles east of SR 59 at reference post 22+05



PREPARED BY:

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May 21, 2014

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B. PHOTOGRAPHS

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D. INSPECTION REPORTS *(included in electronic file only)*

- D-1: Parsons Bridge Inspection Report (2012)
- D-2: INDOT Bridge Inspection Report (2014)

E. HISTORIC BRIDGE DOCUMENTATION

- E-1: National Register of Historic Places Registration Form
- E-2: SHAARD Structural Survey Report
- E-3: Excerpt from *Indiana Historic Bridge Inventory, Volume 2: Listing of Historic and Non-Historic Bridges*, August 2009
- E-4: Indiana Historic Bridge Inventory Condition Score Calculation
- E-5: Indiana Historic Bridge Inventory Individual Review Form
- E-6: Excerpt from *Indiana Historic Bridge Inventory, Volume 4: List of Select and Non-Select Bridges*, August 2009

F. BRIDGE MARKETING DOCUMENTATION

- F-1: Email from Dale Brier, IDNR (March 7, 2013)
- F-2: Email from John Bawcum, Friends of the Panhandle Pathway, Inc. (March 8, 2013)
- F-3: Email from John Bawcum, Friends of the Panhandle Pathway, Inc. (March 16, 2013)
- F-4: Email from Cliff Kunze, Covered Bridge Gateway Trails Association (March 8, 2013)
- F-5: Email from Mike List, Indiana State Parks & Reservoirs
- F-6: Meeting Minutes (April 10, 2013)
- F-7: January 29, 2015 Public Meeting Documentation
- F-8: Letters of Intent from IDNR and Brown County

I. INTRODUCTION

A. Section 4(f) Alternatives Analysis Framework

The Indiana Department of Transportation (INDOT) has identified a need to improve the structural and operational condition of the SR 46 bridge over the Eel River in Clay County (Appendix A, Figures 1-4). The bridge is listed on the National Register of Historic Places (NRHP) and was identified in the Indiana Historic Bridge Inventory (August 2009) as “Select”. Select bridges are those “that are most suitable for preservation and are excellent examples of a given type of historic bridge.”¹

Section 4(f) of the US Department of Transportation Act of 1966 (Title 49, USC, Section 303) requires special considerations be made regarding the “use” of any publicly owned park, recreation area, wildlife/waterfowl refuge or historic property that is listed in or eligible for the NRHP. Prior to any “use” of a Section 4(f) property, an alternatives analysis must be conducted that confirms that there are no “feasible and prudent” alternatives to the “use” of the resource.

Alternatives for this project were developed in accordance with INDOT’s *Historic Bridge Programmatic Agreement Project Development Process* (Historic Bridge PA PDP) and include no build, rehabilitation, and replacement options, with and without relocation of the existing bridge. The evaluation below follows INDOT’s *Historic Bridge Alternatives Analysis Layout* for documentation of this process.

B. Indiana Historic Bridge Inventory

As noted above, the SR 46 bridge over the Eel River was evaluated as part of INDOT’s Historic Bridge Inventory survey. That process, developed in conjunction with the Federal Highway Administration and the Indiana Department of Natural Resources-Division of Historic Preservation and Archaeology (IDNR-DHPA), evaluated the NRHP-eligibility of every state-owned bridge in Indiana and established a systematic framework for how historic bridges shall be considered in the project development process.

Because the SR 46 bridge was already listed in the NRHP, its historic eligibility was not reevaluated (see Appendices E-1, E-2, and E-3). Determination of a bridge’s Select or Non-Select status involves a multi-step process that incorporates both the historic eligibility and the current condition of the bridge. The SR 46 bridge received a “high” eligibility rating (based on its NRHP listing), but a “low” condition rating (29 out a possible 45) (See Appendix E-4). Bridges with this combination of ratings received an “Individual Review” that considered its condition, the feasibility of rehabilitation, and the potential to correct nonstandard elements without affecting its historic integrity. The Individual Review also considered whether the bridge was suitable for reuse as a non-vehicular (bicycle/pedestrian) structure either in its existing location or at a new location.

Through the Individual Review, the SR 46 bridge was found to be Select, based largely on the fact that the structural deficiencies could be corrected without jeopardizing the character-defining features that made it NRHP-eligible (see Appendix E-5). However, the Individual Review also recognized that while a major rehabilitation could make the bridge structurally sound, some deficiencies could not be corrected. As a result, the Historic Bridge Inventory identified the SR 46 bridge as Select for Non-Vehicular Use, indicating it may be better suited for bicycle and/or pedestrian use than for vehicles (see Appendix E-6).

¹ *Programmatic Agreement Regarding Management and Preservation of Indiana’s Historic Bridges*, July 17, 2006 (Historic Bridge PA).

C. Project Development History

In 2009, INDOT determined that action was required to address the deteriorated condition of the bridge. At the time, the Historic Bridge Inventory was not yet complete; however, the bridge was already listed on the NRHP. Due to the condition of the bridge, it was not yet known whether the bridge would be listed as Select or Non-Select. In August 2009, INDOT conducted a field check, during which it was decided that the deterioration was so severe that replacement was appropriate. INDOT reached out to Clay County regarding the possibility of relocating the bridge immediately adjacent to the existing location so that the County could create a park with the bridge as a feature. Clay County indicated that they had no interest in creating a park facility utilizing the bridge.

Volume 4 of the Indiana Historic Bridge Inventory finalized the list of Select and Non-Select bridges, identifying the Eel River Bridge as “Select for Non-Vehicular Use” as described above. While the “Select” designation effectively requires that the bridge remain in use (vehicular or non-vehicular), the “Non-Vehicular Use” label was utilized for bridges that may be more suitable for non-vehicular use due to condition and/or nonstandard geometric features. The Indiana Historic Bridge Inventory did not evaluate whether non-vehicular use was appropriate at the bridge’s existing site, but did consider whether the bridge type was suitable for relocation. In 2009, based on the lack of interest from Clay County to take ownership of the bridge for a park, INDOT reversed its previous decision and decided to proceed with a rehabilitation project.

During 2011, INDOT’s system-wide approach to fracture-critical bridge inspections became more rigorous due to an increased concern that risks were not being fully identified. Prior to that change, the bridge was inspected primarily via climbing from the bridge deck, the use of ladders where possible, and binoculars for inspecting the areas over the water. The use of under-bridge inspection trucks had previously been minimal due to their availability (INDOT owns only two) and the difficulty of threading the truck’s inspection bucket through the truss members. The 2011 inspection used an under-bridge inspection truck allowing the inspector to remove rust and make a more accurate assessment of the condition of the floor beams.

In 2011, Parsons was selected to prepare design plans for the rehabilitation of the Eel River Bridge. During INDOT’s inspection of the Eel River Bridge in November 2011, applying these more rigorous inspection techniques, failed gusset plates and a close-to-failure floor beam were identified, resulting in closure of the bridge. In December 2011, INDOT completed an expedited repair that allowed the structure to reopen, although it still required a more permanent repair. On July 31 and August 1, 2012, Parsons performed an in-depth inspection to determine the scope of the rehabilitation effort. During that inspection, Parsons identified additional concerns regarding the condition of the bridge, including serious deterioration of additional gusset plates and bottom chord splice plates. Based on these findings, Parsons requested the bridge be closed until an additional expedited repair could be designed and implemented. The bridge was closed July 31, 2012 and reopened November 2, 2012 after the repair was complete.

The 2011 and 2012 inspections identified structural deficiencies that were far more serious than those identified previously. During each of the closures numerous complaints from the public and businesses were received due to the long (21.9 miles) detour route. This bridge carries more than 3,300 vehicles per day and is an arterial route and part of the National Truck Network. Based on the public’s negative response to the detour during those closures INDOT determined that it would be prudent to select an option that requires no (or very limited) closure. The severity of the deterioration and need to minimize closures led INDOT to reconsider the appropriateness of rehabilitation and reevaluate all alternatives, which is the purpose of this document.II. **EXISTING STRUCTURE DATA**

This section provides a summary of the structural and geometric features of the existing SR 46 bridge over the Eel River.

A. Identification/History

Bridge No.	046-11-01316C
NBI Number	017050
Project Location	SR 46 over the Eel River, Clay County, INDOT Crawfordsville District
Designation No.	0800910
Year Built	1933
Years Repaired	1977, 2011, 2012
Most Recent Field Inspection Date	5/1/2014
Average Daily Traffic (ADT)/Year of ADT	3,310 (2011) / 4,071 (2034)
Percentage of Commercial Vehicles	9%
Low volume road?	No
Functional Classification	Rural Minor Arterial
Detour Length	21.9 miles
Load Rating	14 tons
Sufficiency Rating	7.0
National Register of Historic Places Status	Listed
Historic Bridge Prioritization Status	Select

B. Structure/Dimensions

Surface Type	1 ½” modified concrete overlay placed on a 6 ½” concrete deck (1977)
Out to Out of Copings	25’-0”
Out to Out of Bridge Floor	402’-4”
Clear Roadway Width	24’-0”
Number of Lanes on Structure	2
Skew	0 degrees
Type of Superstructure	Parker steel through truss
Spans	2 – 198’-0” each
Type of Substructure/Foundation	End bents are reinforced concrete wall on spread footings; Intermediate pier is a solid reinforced concrete wall on piles
Seismic Zone	Zone 1

C. Appurtenances

Bridge Railing	C6 x 8.2 steel channel handrail, 2'-10 ¾" height
Curbs	Concrete 6" wide by 5" high, both sides
Sidewalks	None
Utilities	Overhead electric to south; Buried fiber optic to north
Railroad	None

D. Approaches

Roadway Width	24'-0"
Surface Type	Asphalt over concrete
Guardrail	Steel W-beam, class D-S
Guardrail End Treatment	Curved terminals on the west approach, type OS on the east approach

III. EXISTING CONDITIONS

This section summarizes the condition of the bridge’s structural elements. Except where noted, the information below was obtained from the May 1, 2014 *Bridge Inspection Report* (see Appendix D-2) prepared by INDOT, the most recent INDOT inspection report available. Representative photos from the Inspection Report are provided in Appendix B.

The numerical or condition ratings assigned to each bridge element are on a scale from 0 through 9 in accordance with the Federal Highway Administration’s *Recording and Coding Guide for the Inventory and Appraisal of the Nations Bridges*. The condition ratings are as follows:

- 9 Excellent or new condition
- 8 Very good condition—no problems noted
- 7 Good condition—some minor problems
- 6 Satisfactory condition—structural elements show some minor deterioration
- 5 Fair condition—all primary structural elements are sound but have minor section loss, cracking, spall or scour
- 4 Poor condition—advanced section loss, deterioration, spall or scour
- 3 Serious condition—loss of section, deterioration, spall or scour have seriously affected primary structural components. Local failures are possible. Fatigue cracks in steel or shear cracks in concrete may be present
- 2 Critical condition—Advanced deterioration of primary structural elements. Fatigue cracks in steel or shear cracks in concrete may be present or scour may have removed substructure support. Unless closely monitored, it may be necessary to close the bridge until corrective action is taken
- 1 Imminent Failure—Major deterioration or section loss present in critical structural components or obvious vertical or horizontal movement affecting structure stability. Bridge is closed to traffic but repairs may put back into light service
- 0 Failed—out of service and beyond repair

A. Roadway Geometrics

State Road 46 is on Indiana’s “3R” (Resurfacing, Restoration, and Rehabilitation) System and it is not anticipated that the route would require any change in that status in the next 25 years. 3R design criteria, as outlined in Chapter 55 and Figure 55-3A of the *Indiana Design Manual*, are appropriate for the existing bridge and approaches and would apply if the bridge were rehabilitated. If the bridge is replaced, “4R” (Resurfacing, Restoration, Rehabilitation, and Reconstruction) design criteria, provided in Chapter 53 and Figure 53-2 would apply. The table below shows the Level 1 design criteria (3R) as well as the bridge’s existing dimensions. Level 1 criteria are those that are the most critical indicators of a highway’s safety and serviceability.

SR 46 runs due east-west across most of Clay County, with very few curves. The bridge lies within the tangent section between a slight reverse curve (radii of 8,596 and 11,458) with a computed design speed at or above the posted 55 mph speed limit. The approach roadway is generally flat to either side of the bridge, with grades less than 1%. All curves meet the minimum design speed of 55 mph based on Figures 43-3A(3) (horizontal), 44-3A (crest curves), and 55-4A (sag curves) of the *Indiana Design Manual*.

TABLE 1: LEVEL 1 DESIGN CRITERIA AND EXISTING BRIDGE VALUES

Criteria	Minimum Design Criteria ⁽¹⁾	Existing Value	Meets Standard	Possible to Reconstruct to Standard
Travel Lane Width	12'	11'	No	Yes ⁽²⁾
Usable Shoulder	6'	1'	No	No
Paved Shoulder	2'	1'	No	No ⁽²⁾
Cross Slope	2%	1.5%	No	No ⁽³⁾
Structural Capacity	HS-20	H-20	No	No
Clear Road Width	39'4" ⁽⁴⁾	24'0"	No	No
Vertical Clearance	14'	14'-8" ⁽⁵⁾	Yes	N/A

(1) *Indiana Design Manual*, Chapter 55 and Figure 55-3A

(2) If travel lanes were marked at 12', the usable shoulder width on the bridge would be 0. It is not feasible to widen a through truss bridge without replacing nearly all of the structural components with larger, stronger members.

(3) This truss is unlikely to be able to support additional dead load from increased deck thickness without decreasing the live load capacity.

(4) This is based on two 12' travel lanes, 7' shy line offset distance and 8" barrier offset either side.

(5) This clearance has been obtained by removing the lower sway bracing, which has impacted the historic material integrity of the bridge.

B. Bridge Deck

The deck is in overall satisfactory condition. The wearing surface has transverse cracking over top of every floor beam along with longitudinal cracking. There are a total of 31 patches in the wearing surface, numerous areas of delamination, and several spalls. The curbs exhibit vertical cracking and require repair. Several of the downspouts have rusted off entirely.

TABLE 2: BRIDGE DECK CONDITION RATINGS

	Condition Rating
Wearing Surface	5
Deck Underside	6
Curbs	6
Copings	6
Railings	5
Painted Lines	5
Drains	7
Downspouts	4
Joints	6
Deck (overall)	6

C. Superstructure

The deteriorated condition of the superstructure has required two closures of the bridge in the past three years. During an inspection of the bridge by INDOT in November 2011, failed gusset plates and a close-to-failure floor beam were identified, resulting in a rating of 1 (“Imminent Failure”) and closure of the bridge. In December 2011, INDOT completed an expedited repair that allowed the structure to reopen, although it still had an overall rating of 4 (“Poor”) and required a more permanent repair. On July 31 and August 1, 2012, Parsons performed an inspection to determine the scope of the rehabilitation effort (see Appendix D-1). During that inspection, Parsons identified additional concerns regarding the condition of the bridge and requested the bridge be closed until an additional expedited repair could be designed and implemented. The bridge was closed July 31, 2012 and reopened November 2, 2012 after the repair was complete.

Following these repairs, the condition of the bridge has been reevaluated. The stringers are in Fair condition with minor section loss and continued rusting. Most of the floor beams have some section loss, with individual beams exhibiting section loss ranging from 10-50%. Several of the lower bracing laterals have section loss of 50% or more. Vertical truss members have minor section loss and several members have been damaged by collision. Nearly all steel members show some amount of rusting and/or minor section loss. The lower portion of all sway bracing was removed due to continued collision damage (Appendix B, Photos 26-27). Every gusset plate shows some section loss, while some exhibit significant or complete section loss resulting in a condition rating of 1. The most serious of these gusset plate deficiencies were addressed by the temporary repair. The paint is failing in many areas and was rated as Poor. Photos 20-36 in Appendix B show the generally deteriorated nature of the superstructure.

The 2012 repair designed by Parsons (Appendix B, Photo 37) is anticipated to have a service life of a minimum of 5 years (2017). Following that repair, and based on the findings of Parsons’ 2012 inspection, the superstructure condition was given a rating of 3 in its 2013 inspection (see Appendix D-2). INDOT continues to inspect this bridge annually to monitor its condition.

TABLE 3: SUPERSTRUCTURE CONDITION RATINGS

	Condition Rating		Condition Rating
Bearings	5	Gusset Plates	1
Stringers	5	Stay/Batten Plates	4
Floor Beams	4	Lacings	4
Knee Braces	N/A	Rivets	5
Trusses	4	Bolts	5
Verticals	4	Splice Plates	5
Diagonals	6	Brackets	6
Upper Chords	6	Pins	5
Lower Chords	4	Nuts	6
Upper Bracings	6	Collision Damage	5
Portals	4	Alignment of Members	6
Top Laterals	6	Deflections	6
Lateral Strut	6	Vibrations	6
Sway Bracing	4	Impact	6
Lower Bracing Laterals	3	Noise	6
Connection Plates	3		
Superstructure (overall)	3		
Paint	4		

D. Substructures and Foundations

The substructure is in overall Good condition with some cracking and spalling identified. The river flows from north to south and the channel runs along the west face of the center pier. Originally, the river channel was located under the east span of the bridge. However, due to the high velocity of the river, it has migrated to the west, eroding and destabilizing the channel bank, causing large trees to fall into the river. Today, during a Q100 storm, a rain event that has a 1 percent chance of occurring in a given year, water overtops the west bank by 5000 feet and causes approximately 2 feet of backwater (Appendix B, Photos 16-17). During Parsons’ 2012 inspection, significant erosion was noted on the west bank under the bridge. The calculated scour depths exceed the pier footing depth and it is likely that within 20 years the west abutment and approach embankment will become unstable. Without proper bank protection, the end bent would eventually be undermined and the bridge would require closure.

TABLE 4: SUBSTRUCTURE AND CHANNEL CONDITION RATINGS

Condition Rating		Condition Rating	
<u>Abutments</u>		<u>Channel</u>	
Bridge Seat	7	Scour upstream	7
Backwall	7	Scour downstream	6
Breastwall	7	Drift	7
Wing Walls	5	Vegetation	7
Scour	7	Channel Change	7
Erosion/Undermining	6	Adequacy of Opening	7
Settlement	7	Channel Protection	5
<u>Intermediate Pier</u>		Waterway Adequacy	6
Pier Cap	7	Channel (overall)	5
Column	7		
Erosion/Undermining	7		
Scour/Undermining	7		
Settlement	7		
<u>General</u>			
Concrete	6		
Debris on Bridge Seat	7		
Substructure (overall)	7		

E. Approaches

The roadway approaches are in overall good condition following a road resurfacing project approximately 10 years ago (Appendix B, Photos 2, 3, and 6).

TABLE 5: APPROACH CONDITION RATINGS

Condition Rating	
Alignment	8
Approach Slab	7
Approach Guardrail	7
Approach Pavement	7
Approach Shoulders	7
Approach (overall)	7

IV. PURPOSE AND NEED

The purpose of this project is to provide a safe and structurally sufficient bridge to carry SR 46 over the Eel River.

The primary need for a project at this location is the advanced deterioration, section loss and fatigue affecting critical load-bearing components of this fracture critical bridge. The SR 46 bridge has been closed to traffic twice—once in 2011 and once in 2012—due to an ‘imminent failure’ condition of fracture critical components discovered during inspections by INDOT and Parsons. Expedited repairs were made on both occasions sufficient to reopen the bridge to traffic; however much more extensive reconstruction would be needed for the bridge to remain in long-term service. The bridge is considered structurally deficient and has a sufficiency rating of 45.6.

The nature and volume of existing and proposed traffic on SR 46 necessitates that the bridge be capable of safely carrying modern highway loadings including commercial vehicles, grain haulers, school buses, and emergency vehicles.

In addition to this need, other desired outcomes of the project include:

- Improvements to the hydraulic capacity of the structure and implementation of scour countermeasures;
- A bridge that provides standard lane widths and shoulders and can safely accommodate agricultural equipment;
- An improved intersection at CR 475 East that provides sufficient sight distance;
- Guardrail transitions and end treatments that meet current standards; and
- A bridge that is not subject to frequent or long-term closures for construction, maintenance, or inspection due to the lack of safe, efficient alternative routes and high user costs;

Alternatives meeting this purpose and need will be weighed based on their ability to balance feasibility, cost-effectiveness, and environmental impacts.

V. ALTERNATIVES

As described above, Section 4(f) and the INDOT Historic Bridge PA PDP require the systematic evaluation of alternatives for this project. The alternatives analysis must prove why each alternative either is or is not feasible and prudent, and it should document the justification for the decision to proceed with the preferred alternative. The regulations state that a potential avoidance alternative is not “feasible” if it cannot be built as a matter of sound engineering judgment (23 CFR 774.17), it is not possible to engineer, design and build. The term "prudent" means there are no unique problems or unusual factors involved with the use of such alternatives. Per 23 CFR 774.17, an alternative is not prudent if:

- It compromises the project to a degree that it is unreasonable to proceed with the project in light of its stated purpose and need;
- It results in unacceptable safety or operational problems;
- After reasonable mitigation, it still causes:
 - Severe social, economic, or environmental impacts;
 - Severe disruption to established communities;
 - Severe disproportionate impacts to minority or low income populations; or
 - Severe impacts to environmental resources protected under other Federal statutes;
- It results in additional construction, maintenance, or operational costs of an extraordinary magnitude;
- It causes other unique problems or unusual factors; or
- It involves multiple factors that while individually minor, cumulatively cause unique problems or impacts of extraordinary magnitude.

The Historic Bridge PA PDP establishes the criteria for determining feasibility and prudence for projects involving historic bridges in Indiana. The Historic Bridge PA PDP is available at: <http://www.in.gov/indot/2531.htm>.

A. Alternative 1: No Build

Alternative Description

The No Build alternative would make no improvements to this bridge at this time (Appendix A, Figure 5). INDOT would continue its current inspection program to identify structural deficiencies and would address issues as required. As described in Section III above, the expedited repair implemented by INDOT in 2012 has an anticipated minimum lifespan of five years. Therefore, it is anticipated that sometime in 2017 or later, the bridge would require a permanent solution or would need to be closed to traffic. INDOT would continue to monitor the structure to ensure the safety of motorists.

Because of the age and condition of this structure, it is impossible to anticipate the cost of repairs that would be needed or when the bridge would require closure.

Compliance with Design Standards

The No Build Alternative would make no improvements to the structure, leaving all design elements in their current state. As shown in Table 6, the bridge does not meet INDOT Design Criteria for travel lane width and shoulder width on the bridge and approaches, clear roadway width and structural capacity on the bridge, and cross slope on the approaches.

TABLE 6 - DESIGN CRITERIA FOR ALTERNATIVE 1

Design Element	Minimum Design Criteria ⁽¹⁾	Existing Condition	Proposed Condition	Level 1 Design Exception Required
Bridge Features				
Travel Lane	12'	11'	11'	Yes
Shoulder	6' (minimum)	1'	1'	Yes
Structural Capacity	HS-20	H-20	H-20	Yes
Clear Roadway Width	40'	24'	24'	Yes
Vertical Clearance	14'	14'-8" ⁽²⁾	14'-8"	No
Roadway Features				
Travel Lane	12'	11'	11'	Yes
Shoulder Width	6'	1'	1'	Yes
Stopping Sight Distance at Vertical Curve	495'	1,124'	1,124'	No
Maximum Grade	5%	0.59%	0.59%	No
Through Lane Cross Slope	2%	1.5%	1.5%	Yes

(1) *Indiana Design Manual*, Chapter 55 and Figure 55-3A

(2) Vertical clearance has been achieved through the removal of the lower sway bracing.

Hydraulics

The lowest point of the existing bridge is located at approximately elevation 574.05 feet above sea level. The Q₁₀₀, the elevation at which there is a 1% chance of a storm event of the magnitude in any given year, for this bridge is 573.00 above sea level. The *Indiana Design Manual* requires a minimum of 2 feet of freeboard, clearance between the Q₁₀₀ and the bottom of the bridge, to allow for passage of ice and debris. The existing SR 46 bridge over the Eel River does not meet that standard and the No Build alternative would not alter that condition.

Historic Bridge Effects

This alternative would not alter the historic elements of the structure. The lower sway bracing, which was removed by INDOT, would remain as-is. However, the bridge would continue to deteriorate until closure was required.

Right-of-Way

The No Build alternative would require no right-of-way.

Utilities

The No Build alternative would have no impact on existing utilities in the corridor.

Maintenance of Traffic

Because there is no construction associated with this alternative, no maintenance of traffic plan is required. However, if, as a result of its continued deterioration, the bridge was closed temporarily for repairs or permanently, the official detour would use SR 59 and SR 246 (see Appendix C, page 51), adding 7 miles to a through trip. SR 246 is a narrow, winding rural roadway not well suited to carry 159 commercial vehicles a day. When the bridge was closed in 2011 due to the condition of the bridge, the district received complaints and safety concerns from the public about the number of trucks on SR 246. When SR 46 was closed again in 2012, commercial traffic was routed along SR 59, I-70 and US 231 through Spencer, an additional approximately 22.5 miles. The district again received complaints from users and elected officials due to the additional distance. There is no adequate local road detour. CR 200 crosses the Eel River to the southwest, but doesn't afford significant time or mileage savings over the SR 59 and SR 246 official state detour.

Environmental Issues

This alternative would cause no direct environmental impacts. If the bridge required closure for a long duration, the diversion of traffic could have traffic-related impacts on other communities along the alternative route(s) that vehicles utilized.

Cost

The No Build Alternative does not include any improvements and, therefore, has no cost. As noted above, it is not possible to estimate the costs associated with any repairs that would be required or the user costs associated with any temporary or permanent closures. If the structure were closed for a long duration (or permanently) it may be necessary to make improvements to other roadways in the area to improve access or to allow them to accommodate the additional traffic.

Section 4(f) Evaluation

The No Build Alternative requires no design or construction; therefore, **it is a feasible alternative**. It would, however, retain the non-standard features identified above and the hydraulic capacity would remain insufficient. Further, this alternative does not provide a safe, reliable transportation facility for the SR 46 corridor. **It does not, therefore, meet the project's purpose and need and is not a prudent alternative**. It will, however, be retained throughout the project's development for comparison purposes as required by the National Environmental Policy Act.

B. Alternative 2: Rehabilitation for Continued Vehicular Use

Alternative Description

The scope of the rehabilitation described here is based on visual inspection and engineering judgment only. A detailed three-dimensional model could be used to refine the extent of improvements if this alternative was to be investigated further. This alternative would undertake a major rehabilitation of the existing bridge (Appendix A, Figure 6) including:

- Replacement of approximately 80% of lower chord members;
- Replacement of all gusset plates at the end bents and center pier;
- Replacement of approximately 50% of other gusset plates;
- Replacement of approximately 75% of splice plates, cover plates, and batten plates;
- Replacement of approximately 50% of the lower lateral cross bracing and corner support angles;
- Replacement of approximately 25% of vertical members;
- Replacement of the floor beams at each end bent and pier;
- Replacement of the existing bridge deck;
- Replacement of exterior stringers (once the deck is removed additional stringers may be identified for replacement);
- Reinstallation of portal and sway bracing (will be thicker, more compact section to allow vertical clearance requirement to be met);
- Replacement of all bridge railing;
- Replacement of rivets with round-headed bolts where members are replaced;
- Cleaning and painting of the entire bridge; and
- Patching of concrete on the abutments and center pier.

This alternative would be expected to extend the life of the structure by approximately 25 years. If the work was completed in 2016, the bridge would require additional rehabilitation in 2041, when major remaining elements would be 108 years old.

On the east side of the bridge, the approach roadway would be reconstructed for a length of approximately 300 feet to provide wider shoulders, add guardrail, and modify the driveway entrance to improve sight distance. On the west side, the reconstruction would also include relocating the intersection of CR 475 E and SR 46 approximately 200 feet to the west in order to improve the sight distance for vehicles entering from CR 475 E.

Compliance with Design Standards

This alternative would be designed to meet 3R standards as defined in the *Indiana Design Manual*. Due to the nature of truss bridges, it is not possible to address deficiencies related to the width of the structure without completely reconstructing the bridge (see Table 7). As such, design exceptions for lane, shoulder, and clear roadway width would be required. The bridge was originally designed with an H-20 structural capacity (20-ton truck) and the rehabilitation would restore this capacity. However, current design standards require accommodation for HS-20 structural capacity (36 ton truck); therefore, this alternative would require a Level 1 design exception from INDOT and FHWA. Based on this bridge's location on a National Truck Route and the number of heavy trucks known to use the bridge, INDOT and FHWA have indicated that this design exception would not be approved.

Hydraulics

Alternative 2 would make no changes to the elevation of the bridge, the substructure, or the channel. As such, this alternative would not meet the 2-foot freeboard requirement.

Historic Bridge Effects

No formal determination has been made as to whether the improvements described above would meet the *Secretary of the Interior’s Standards for Rehabilitation*. However, it is anticipated that structural materials would be replaced in-kind and the integrity of the truss would be retained. Rivets would be replaced with round-headed bolts to retain visual similarity. Sway bracing would be re-installed – with some modifications – so as to not recreate the clearance issues that led to its removal.

Right-of-Way

Alternative 2 would require approximately 2.0 acres of new right-of-way from adjacent properties to allow for the improvements to the bridge, its approaches, and the realignment of CR 475 E.

Utilities

Overhead utility lines parallel the roadway to the south. Alternative 2 would require the relocation of approximately 2 utility poles as part of the realignment of CR 475 E.

TABLE 7 - DESIGN CRITERIA FOR ALTERNATIVE 2

Design Element	Minimum Design Criteria ⁽¹⁾	Existing Condition	Proposed Condition	Level 1 Design Exception Required
Bridge Features				
Travel Lane	12'	11'	11'	Yes
Shoulder	6' (minimum)	1'	1'	Yes
Structural Capacity	HS-20	H-20	H-20	Yes
Clear Roadway Width	40'	24'	24'	Yes
Vertical Clearance	14'	14'-8" ⁽²⁾	14'-8"	No
Roadway Features				
Travel Lane	12'	11'	12'	No
Shoulder Width	6'	1'	8'	No
Stopping Sight Distance at Vertical Curve	495'	415'	501'	No
Maximum Grade	5%	3.7%	3.7%	No
Through Lane Cross Slope	2%	1.5%	2%	No

(1) *Indiana Design Manual*, Chapter 55 and Figure 55-3A

(2) Vertical clearance has been achieved through the removal of the lower sway bracing.

Maintenance of Traffic

Rehabilitation of the existing bridge would require the full closure of SR 46 for approximately 9 months. During this time, the posted detour would use SR 59 and SR 246 (see Appendix C, page 51), adding 7 miles to a through trip. This is the same detour route used during the closure in 2011. As noted previously, SR 246 is a narrow, winding rural roadway not well suited to large trucks, resulting in numerous complaints from the public when this was used as a detour route during the 2011 repair project.

Environmental Issues

Environmental surveys, including the Waters of the U.S. Determination Report, are still in progress; therefore, this assessment is preliminary and qualitative. Reconstruction work on the approaches to the bridge would potentially cause minor impacts to a stream located in the southeast quadrant of the bridge. The jurisdictional status of other water features in the area

has not been determined. Minimal tree clearing may also be required. Impacts could potentially be minimized or eliminated during final design through the use of steeper slopes or retaining walls. Impacts to Waters of the US would be mitigated as required through the Section 404/401 permitting process. Potential impacts to other resources, including threatened and endangered species and the Eel River floodway will be reported in the project’s Categorical Exclusion (CE) document and mitigated as appropriate. This alternative would also result in traffic-related impacts on other communities along the alternative route(s) that vehicles utilized during construction.

Cost

Alternative 2 would cost \$4,838,780 to construct and would have user costs², resulting from time and operating expenses associated with the longer, slower detour of \$4,848,363, for a total project cost of \$9,687,143. Additional cost details are provided in Appendix C, pages 1-4 and pages 47-48. Due to its fracture critical nature, the bridge would continue to be inspected at one-year intervals (instead of the typical two-year interval for non-fracture-critical bridges), requiring expenditures not captured above.

Construction Cost*	\$4,768,780
ROW/Utilities	\$70,000
Project Cost	\$4,838,780
User Costs	\$4,848,363
TOTAL COST	\$9,687,143

*Includes bridge rehabilitation and roadway improvements

Section 4(f) Evaluation

It would be possible to design and build Alternative 2; however, it would not meet structural capacity requirements. The H-20 load rating does not meet the needs of the corridor and, therefore, this alternative **does not meet the project’s purpose and need**.

During the Individual Review for this bridge as part of the Historic Bridge Inventory Select/Non-Select analysis, it was determined that this bridge could not be rehabilitated to meet current applicable design standards and that design exceptions would not be appropriate for this bridge. As a result, the Individual Review designated the bridge Select for Non-Vehicular Use, indicating it may be better suited for bicycle and/or pedestrian use than for vehicles. Therefore, Alternative 2 **is not a feasible alternative**. While Alternative 2 would provide a reliable transportation corridor for at least 25 years, it requires an investment of almost \$5 million and would cause user costs of an equal amount during the rehabilitation process. The Historic Bridge PA PDP establishes that if the cost of rehabilitation is equal to or greater than 80% of the replacement cost, it may not be suitable for rehabilitation. Alternative 2 exceeds this threshold when compared to several of the replacement alternatives (see Table 14). This alternative would retain the non-standard features identified above, it would not meet the 2-foot freeboard requirement, and the location of the west abutment would leave it subject to scour and the need for countermeasure maintenance. Based on this evaluation, Alternative 2 is **not a prudent alternative**.

² User costs were included in the evaluation due to the concerns raised by businesses and the public regarding safety and delays during the short-term closures associated with the 2011 and 2012 repair projects. User costs were calculated based on the methodology provided in the *Indiana Design Manual*, Section 81-4.02(2). User cost calculations for each alternative are provided in Appendix C.

C. Alternative 3: Rehabilitation for Continued Vehicular Use/One-Way Pair

Alternative Description

This alternative would construct a new bridge parallel to the existing bridge and rehabilitate the existing bridge, with each structure carrying a single lane of traffic. This alternative includes constructing a new bridge approximately 20’ to the south of the existing structure (Appendix A, Figure 7) to carry eastbound traffic, retaining westbound traffic on the existing structure. To accommodate this directional split, the eastbound SR 46 roadway would shift to the south starting approximately 0.5 mile west of the bridge, travel across the new bridge over the Eel River, and re-join the existing SR 46 alignment approximately 0.25 mile east of the river. The new bridge would be a 5-span, 525-foot long structure with an estimated service life of 75 years. In accordance with the *Historic Bridge Alternatives Analysis Layout*, the new bridge would be constructed to accommodate future 2-way travel, for the time when the existing bridge can no longer be maintained.

To allow for the additional structure depth of a new bridge and to provide a minimum 2 feet of freeboard, the profile of the existing roadway would need to be raised approximately 8 feet.

The existing bridge would be rehabilitated in the same way described above for Alternative 2, with the same service life expectations (25 years).

Compliance with Design Standards

The new bridge would be designed to meet 4R standards as defined in the *Indiana Design Manual*, while the existing bridge would be rehabilitated to 3R standards, as shown in Table 8.

TABLE 8 - DESIGN CRITERIA FOR ALTERNATIVE 3

Design Element	Minimum Design Criteria	Existing Condition	Proposed Condition	Level 1 Design Exception Required
Bridge Features – Existing Bridge ⁽¹⁾				
Travel Lane	12'	11'	12'	No
Shoulder	6' (minimum)	1'	6'	No
Structural Capacity	HS-20	H-20	H-20	Yes
Clear Roadway Width	40'	24'	24'	No
Vertical Clearance	14'	14'-8" ⁽²⁾	14'-8"	No
Bridge Features – New Bridge ⁽³⁾				
Travel Lane	12'	11'	12'	No
Shoulder	6' (minimum)	1'	8'	No
Structural Capacity	HL-93	H-20	HL-93	No
Clear Roadway Width	40'	24'	40'	No
Vertical Clearance	14'	14'-8" ⁽²⁾	N/A ⁽⁴⁾	No
Roadway Features ⁽¹⁾				
Travel Lane	12'	11'	12'	No
Shoulder Width	6'	1'	10'	No
Stopping Sight Distance at Vertical Curve	495'	415'	501'	No
Maximum Grade	5%	6.74	7.16%	Yes
Through Lane Cross Slope	2%	2%	2%	No

- (1) *Indiana Design Manual*, Chapter 55 and Figure 55-3A
- (2) Vertical clearance has been achieved through the removal of the lower sway bracing.
- (3) *Indiana Design Manual*, Chapter 53 and Figure 53-2
- (4) The new bridge will have no vertical obstructions.

The new bridge would meet all applicable design criteria. With only one lane utilizing the 24-foot wide bridge, the rehabilitated existing bridge would meet design standards for lane width and shoulders. The bridge was originally designed with an H-20 structural capacity (20-ton truck) and the rehabilitation would restore this capacity. However, current design standards require accommodation for HS-20 structural capacity (36 ton truck); therefore, this alternative would require a Level 1 design exception from INDOT and FHWA. Based on this bridge's location on a National Truck Route and the number of heavy trucks known to use the bridge, INDOT and FHWA have indicated that this design exception would not be approved.

The approach roadways would meet all design criteria, except for maximum grade at the eastern end of the project as the roadway approaches Bowling Green. This grade exists today and correcting it would be cost-prohibitive.

Hydraulics

The new bridge would be constructed with a low elevation of 576.00 feet above sea level, providing more than 3 feet of freeboard above the Q100 elevation (573.00 feet above sea level). Alternative 3, however, would make no changes to the elevation of the existing bridge, its substructure, or the channel. As such, the rehabilitated existing bridge would not meet the 2 foot freeboard requirement. Further, while a detailed hydraulic analysis has not been completed, it is anticipated that the analysis would show that the new bridge's west abutment would be required to line up with the existing bridge's abutment. Therefore, it would be subject to the same scour issues experienced by the existing bridge and would require regular maintenance of the installed countermeasures (likely riprap). As per the Historic Bridge PA, the existing bridge would be maintained for a minimum of 25 years; however, should it be removed after that time, the new bridge would remain in its hydraulically undesirable location for the rest of its service life (75 years).

Historic Bridge Effects

No formal determination has been made as to whether the improvements described above would meet the *Secretary of the Interior's Standards for Rehabilitation*. However, it is anticipated that structural materials would be replaced in-kind and the integrity of the truss would be retained. Rivets would be replaced with round-headed bolts to retain visual similarity. Sway bracing would be re-installed – with some modifications – so as to not recreate the clearance issues that led to its removal.

Right-of-Way

Alternative 3 would require approximately 13.9 acres of new right-of-way from 7 parcels to allow for the construction of the new eastbound bridge and approach roadways and the realignment of CR 475 E.

Utilities

Overhead utility lines parallel the roadway to the south. Alternative 3 would require the relocation of approximately 8 utility poles.

Maintenance of Traffic

During construction of the new bridge and approaches traffic would be maintained on the existing SR 46 roadway and bridge. All traffic would then be shifted to the new bridge during the rehabilitation of the existing bridge. No disruption to SR 46 traffic is anticipated except at the

location where the new road is tied into the existing one. At no time is it anticipated that SR 46 would be completely closed to traffic.

Environmental Issues

Environmental surveys, including the Waters of the U.S. Determination Report, are still in progress; therefore, this assessment is preliminary and qualitative. Construction of the new bridge to the south would potentially cause moderate impacts to a stream located in the southeast quadrant of the bridge and would require moderate tree clearing. The jurisdictional status of other water features in the area has not been determined. Impacts to Waters of the US would be mitigated as required through the Section 404/401 permitting process. Potential impacts to other resources, including threatened and endangered species and the Eel River floodway will be reported in the project’s CE document and mitigated as appropriate.

Cost

Alternative 3 would cost \$11,349,048 to construct and would have user costs, resulting from time and operating expenses associated with reduced speeds through the construction zone of \$81,081, for a total project cost of \$11,430,129. Additional cost details are provided in Appendix C, pages 5-10 and page 50. Due to its fracture critical nature, the bridge would continue to be inspected at one-year intervals (instead of the typical two-year interval for non-fracture-critical bridges), requiring expenditures not captured above.

Construction Cost*	\$11,075,048
ROW/Utilities	\$274,000
Project Cost	\$11,349,048
User Costs	\$81,081
TOTAL COST	\$11,430,129

*Includes rehabilitation of existing bridge, the new bridge, and roadway improvements

Section 4(f) Evaluation

It would be possible to design and build Alternative 3; however, it would not meet structural capacity requirements. The H-20 load rating does not meet the needs of the corridor and, therefore, this alternative **does not meet the project’s purpose and need**.

During the Individual Review for this bridge as part of the Historic Bridge Inventory Select/Non-Select analysis, it was determined that this bridge could not be rehabilitated to meet current applicable design standards and that design exceptions would not be appropriate for this bridge. As a result, the Individual Review designated the bridge Select for Non-Vehicular Use, indicating it may be better suited for bicycle and/or pedestrian use than for vehicles. Therefore, Alternative 3 **is not a feasible alternative**. Alternative 3 would address some of the geometric deficiencies by only placing a single lane of traffic on the existing bridge, but the existing bridge would retain its insufficient freeboard, leaving it at risk for damage due to ice or debris, and the location of the west abutment would leave it subject to scour and the need for countermeasure maintenance. The Historic Bridge PA PDP establishes that if the cost of rehabilitation is equal to or greater than 80% of the replacement cost, it may not be suitable for rehabilitation. At a cost of \$11,349,048, this is the most expensive alternative to construct and would exceed this threshold (see Table 14). Based on this evaluation, Alternative 3 is **not a prudent alternative**.

D. Alternative 4: Bypass/Non-Vehicular Use

Alternative Description

This alternative includes constructing a new bridge approximately 20’ to the south of the existing structure (Appendix A, Figure 8). The alignment of SR 46 would need to be adapted to access this new structure. Starting about 0.5 mile west of the bridge, SR 46 would diverge to the south of the existing alignment and require a reverse curve formation in order to merge back into the

existing roadway alignment approximately 0.25 mile east of the bridge. To allow for the additional structure depth of a new bridge and to provide a minimum 2 feet of freeboard, the profile of the existing roadway would need to be raised approximately 8 feet. The new bridge would be a 5-span, 525-foot long structure with an estimated service life of 75 years.

Once complete, all SR 46 traffic would utilize the new structure. The existing bridge would be retained for non-vehicular (pedestrian) use. Given the decreased loading associated with pedestrian use, the extent of rehabilitation would not be quite as extensive as required for vehicular use. The scope of the rehabilitation described here is based on visual inspection and engineering judgment only. A detailed three-dimensional model could be used to refine the extent of improvements if this alternative was to be investigated further. Based on this review, the following improvements are proposed:

- Replacement of approximately 25% of lower chord members;
- Replacement of all gusset plates at the end bents and center pier;
- Replacement of approximately 50% of other gusset plates;
- Replacement of approximately 25% of splice plates, cover plates, and batten plates;
- Replacement of approximately 10% of the lower lateral cross bracing and corner support angles;
- Replacement of approximately 10% of vertical members;
- Replacement of the floor beams at each end bent and pier;
- Replacement of the existing bridge deck;
- Replacement of exterior stringers (once the deck is removed additional stringers may be identified for replacement);
- Reinstallation of portal and sway bracing;
- Replacement of bridge railing;
- Replacement of rivets with round-headed bolts where members are replaced; and
- Cleaning and painting of the entire bridge.

The existing roadway approaches would provide access to the existing bridge for vehicles and/or pedestrians. While not included in the current design, a sidewalk or multi-use path could be provided from Bowling Green as well. The unincorporated town of Bowling Green, located approximately 0.25 mile to the east of the existing bridge with a population of approximately 250, is the closest population center and does not commonly draw visitors from other areas.

At a December 4, 2014 meeting with Consulting Parties, a request was made to INDOT to conduct outreach to Clay County and the public to determine the level of interest in retaining the bridge in its current location. On January 29, 2015, INDOT held a public meeting in Bowling Green to provide an overview of the project, including the bridge's condition, the alternatives under consideration, and the potential to relocate the bridge to Brown County. The presentation also included the requirements for a party seeking to take ownership of the bridge. A copy of the materials presented at the meeting, as well as the comments received is provided in Appendix F-7.

The deadline for a party to step forward was originally set as March 30, 2015; however, based on comments received at the meeting and during the comment period, INDOT extended this deadline to the time of the public hearing, currently anticipated for the first week of August 2015, a period of more than six months from the date of the public meeting.

To date, no parties have stepped forward to take responsibility for the structure and retain it in place.

Compliance with Design Standards

The new bridge would be designed to meet 4R standards as defined in the *Indiana Design Manual* as shown in Table 9.

The new bridge would meet all applicable design criteria. The approach roadways would meet all design criteria, except for maximum grade at the eastern end of the project as the roadway approaches Bowling Green. The steep grade exists today and correcting it would be cost-prohibitive.

The structural capacity of the pedestrian bridge is based on an H10 design vehicle, which would accommodate typical maintenance vehicles that may need to utilize the bridge.

Hydraulics

The new bridge would be constructed with a low elevation of 576.00 feet above sea level, providing more than 3 feet of freeboard above the Q100 elevation (573.00 feet above sea level). Alternative 4, however, would make no changes to the elevation of the existing bridge, its substructure, or the channel. As such, the existing bridge, repurposed for pedestrian use, would not meet the 2 foot freeboard requirement. Further, while a detailed hydraulic analysis has not been completed, it is anticipated that the analysis would show that the new bridge's west abutment would be required to line up with the existing bridge's abutment. Therefore, it would be subject to the same scour issues experienced by the existing bridge and would require regular maintenance of the installed countermeasures (likely riprap). As per the Historic Bridge PA, the existing bridge would be maintained for a minimum of 25 years; however, should it be removed after that time, the new bridge would remain in its hydraulically undesirable location for the rest of its service life (75 years).

TABLE 9 - DESIGN CRITERIA FOR ALTERNATIVE 4

Design Element	Minimum Design Criteria	Existing Condition	Proposed Condition	Level 1 Design Exception Required
New Bridge Features ⁽¹⁾				
Travel Lane	12'	11'	12'	No
Shoulder	10'	1'	10'	No
Structural Capacity	HL-93	H-20	HL-93	No
Clear Roadway Width	44'	24'	44'	No
Vertical Clearance	16.5'	14'-8" ⁽²⁾	N/A ⁽³⁾	No
Pedestrian Bridge Features ⁽⁴⁾				
Structural Capacity	H-10	H-20	H-10	No
Roadway Features ⁽¹⁾				
Travel Lane	12'	11'	12'	No
Shoulder Width	10'	1'	10'	No
Stopping Sight Distance at Vertical Curve	570'	415'	579'	No
Maximum Grade	3%	2.74%	7.16%	Yes
Through Lane Cross Slope	2%	2%	2%	No

(1) *Indiana Design Manual*, Chapter 53 and Figure 53-2

(2) Vertical clearance has been achieved through the removal of the lower sway bracing.

(3) The new bridge will have no vertical obstructions.

(4) LRFD Guide Specifications for the Design of Pedestrian Bridges

Historic Bridge Effects

No formal determination has been made as to whether the improvements described above would meet the *Secretary of the Interior’s Standards for Rehabilitation*. However, it is anticipated that structural materials would be replaced in-kind and the integrity of the truss would be retained. Rivets would be replaced with round-headed bolts to retain visual similarity and sway bracing would be re-installed.

Right-of-Way

Alternative 4 would require approximately 13.9 acres of new right-of-way from 7 parcels to allow for the construction of the new eastbound bridge and approach roadways and the realignment of CR 475 E.

Utilities

Overhead utility lines parallel the roadway to the south. Alternative 4 would require the relocation of approximately 8 utility poles.

Maintenance of Traffic

During construction of the new bridge and approaches traffic would be maintained on the existing SR 46 roadway and bridge. No disruption to SR 46 traffic is anticipated except at the location where the new road is tied into the existing one. At no time is it anticipated that SR 46 would be completely closed to traffic.

Environmental Issues

Environmental surveys, including the Waters of the U.S. Determination Report, are still in progress; therefore, this assessment is preliminary and qualitative. Construction of the new bridge to the south would potentially cause moderate impacts to a stream located in the southeast quadrant of the bridge and would require moderate tree clearing. The jurisdictional status of other water features in the area has not been determined. Impacts to Waters of the US would be mitigated as required through the Section 404/401 permitting process. Potential impacts to other resources, including threatened and endangered species and the Eel River floodway will be reported in the project’s CE document and mitigated as appropriate.

Cost

Alternative 4 would cost \$10,260,836 to construct and would have user costs, resulting from time and operating expenses associated with reduced speeds through the construction zone of \$81,081, for a total cost of \$10,341,917. Additional cost details are provided in Appendix C, pages 11-16 and page 50.

Construction Cost*	\$9,986,836
ROW/Utilities	\$274,000
Project Cost	\$10,260,836
User Costs	\$81,081
TOTAL COST	\$10,341,917

*Includes rehabilitation of existing bridge, the new bridge, and roadway improvements

Section 4(f) Evaluation

It would be possible to design and build Alternative 4; therefore, **it is a feasible alternative**. Alternative 4 would provide a safe, reliable, and cost-effective structure to carry all traffic in the SR 46 corridor. The bridge and roadway would meet nearly all design criteria, with a design exception required only for the grade approaching Bowling Green. The existing bridge, repurposed for pedestrian use, would retain its insufficient freeboard, leaving it at risk for damage due to ice or debris, and the location of the west abutment would leave it subject to scour and the need for countermeasure maintenance. Based on the location of the bridge in a sparsely populated area, INDOT believes that the pedestrian usage of the existing bridge would be minimal and provide little value to the general public as a historic site compared to its

potential use at other locations. As described below, several groups expressed interest in utilizing the bridge as part of planned, high-demand trail networks.

Based on the reasons above, Alternative 4 has been identified as **not prudent**, pending outreach to local stakeholders regarding the potential demand for the bridge to remain in place.

E. Alternative 5: Bridge Replacement/Relocation of Historic Bridge

Alternative Description

This alternative includes the construction of a new bridge over the Eel River and relocation of the existing bridge to a new location for use as a pedestrian/bicycle facility. As is the case in any bridge replacement project, there are several options for construction methods and alignment. Five options – or subalternatives – were developed for consideration under this alternative:

- 5A – Bridge Replacement on Existing Alignment – Full Detour
- 5B-S – Bridge Replacement on Existing Alignment – Temporary Bridge to South
- 5B-N – Bridge Replacement on Existing Alignment – Temporary Bridge to North
- 5C-S – Bridge Replacement on New Alignment to South (Preliminary Preferred Alternative)
- 5C-N – Bridge Replacement on New Alignment to North

Each option would provide a new bridge that would provide a safe, reliable, cost-effective structure for vehicles in the SR 46 corridor. The new bridge would be a 5-span, 525-foot long structure with an estimated service life of 75 years. Each would also relocate the existing historic bridge to a new location where it would be highly utilized and maintained for a minimum of 25 years. The primary differences are in the location of the new bridge, the approach to maintaining traffic during construction, and potential user costs.

Bridge Relocation Options

In accordance with the Historic Bridge PA PDP, this alternative would require the identification of a suitable location for the structure, as well as an organization willing to commit to taking ownership and maintenance responsibility. It would also require INDOT, as the bridge's current owner, to pay for the cost to rehabilitate and relocate the structure. The IDNR Division of Outdoor Recreation maintains an email list of individuals and organizations involved in the development and improvement of recreational trails. At INDOT's request, information regarding the existing SR 46 bridge, including dimensions, conditions, and adoption requirements, was distributed to more than 300 people (see Appendix F-1).

Three interested parties responded to IDNR's solicitation: John Bawcum, Friends of the Panhandle Pathway, Inc. (see Appendices F-2 and F-3); Cliff Kunze, Covered Bridge Gateway Trails Association (see Appendix F-4); and Mike List, Indiana State Parks & Reservoirs (see Appendix F-5). The Panhandle Pathway was interested in using the SR 46 bridge (or more likely, one of the spans) to provide a grade-separated trail crossing of SR 14 in Winamac, Indiana. The Covered Bridge Gateway Trails Association expressed interest in relocating the SR 46 bridge as part of a rails-to-trails project in Parke County. The proposal from Indiana State Parks & Reservoirs was to use the bridges at two locations of the Salt Creek Trail, which is under development near Brown County State Park.

INDOT reviewed the three requests and determined that the Salt Creek Trail option was the best option for preserving the bridge and in the best interest of the State (see Appendix F-6). The Salt Creek Trail project has been under development for approximately 10 years and, as of this year, one segment is open and three of its four remaining segments (including the one

where the bridges would be placed) are fully funded. A Categorical Exclusion (CE) document was completed in 2007 for the entire trail; due to some alignment changes a portion of the trail will be re-evaluated in a new CE document in the next year. The anticipated high usage (10,000 people per year) and the location of one of the bridge spans immediately adjacent to SR 46 at Eagle Park will provide a high level of visibility for the spans. While using the bridge for the Salt Creek Trail project would require separation of the bridge into its two component spans, based on the other responses received and INDOT's past experience with bridge relocation for recreational trails, due to the length of this bridge any other proposal to reuse the bridge would likely do the same.

Since selecting the Salt Creek Trail location as the proposed relocation option, additional investigations and analyses have been conducted in the areas where the two spans would be placed. A hydraulic analysis has been conducted to confirm the requirements for span lengths and location and preliminary field investigations have been conducted to identify potential environmental resources. An approach that would keep the two spans together as part of the Salt Creek Trail was evaluated; however, the topography, hydraulic conditions, and presence of wetlands in the area, make that option impractical. These preliminary investigations confirmed that using the spans at two separate locations was the only practical option.

The Salt Creek Trail

Under each of the Alternative 5 options (A, B-S, B-N, C-S, and C-N), the existing bridge would be rehabilitated and relocated for use on the Salt Creek Trail, a 2.5-mile multi-use trail connecting Nashville, Indiana to Brown County State Park, two heavily visited tourist destinations (See Figure 9). The purpose of the trail project is to provide an alternative transportation mode for pedestrians that are currently using State Road 46 to travel to land uses in and between Nashville and Brown County State Park. The conflict between pedestrians and the motoring public is currently unsafe. The trail will reduce traffic congestion between the County's three largest motels and the shops in Nashville by providing pedestrian access rather than visitors driving to the shopping areas. In addition, the trail will provide a safe means of transportation for the youth of Nashville and Brown County, as the trail will connect with the Brown County School Corporation sports facilities.

The trail has been under development for several years, with construction of the first phase breaking ground earlier this year. The project includes two crossings of Salt Creek, approximately 0.7 mile apart from one another. The SR 46 bridge is comprised of two 198 foot long trusses that are structurally independent and are of an appropriate length to span the two Salt Creek crossings. The current cost estimate for the trail project, assuming the construction of new bridges at the two stream crossings, is \$5,000,000 with construction to be completed in 2017.³ **When complete, it is anticipated that approximately 10,000 people will use the trail each year.**

While a formal agreement will be developed later in the project process, under the plan INDOT, which is obligated under the Historic Bridge PA to ensure the bridge is preserved, will pay to dismantle the existing bridge, replace or rehabilitate any elements that require it, construct new foundations, and install the truss spans in their new locations. It is anticipated that the span to be located adjacent to SR 46 at Eagle Park would be owned and maintained by Brown County, while the span located within Brown County State Park would be owned and maintained by IDNR. Each agency will be required to sign an agreement committing to maintain their

³ The trail project is being built in segments as funding becomes available. This cost estimate was developed prior to the availability of the Eel River spans and assumed construction of two new bridges at these locations. As such, the cost estimate for the trail would be reduced by some amount if the Eel River spans were relocated to the trail.

respective structures for a minimum of 25 years. However, it is anticipated that, based on the anticipated visitation levels, the bridges would be retained far beyond that minimum. IDNR and Brown County have each submitted a letter of intent to take responsibility for the bridge spans (Appendix F-8).

Compliance with Design Standards

Each of the Alternative 5 options would be designed to meet 4R standards as defined in the *Indiana Design Manual*. None of the options would address the maximum grade on the approach into Bowling Green. Design standard compliance details for each option are provided in the sections below.

Hydraulics

Under each Alternative 5 option, the new bridge would be constructed with a low elevation of 576.00 feet above sea level, providing more than 3 feet of freeboard above the Q100 elevation (573.00 feet above sea level). The west abutment of the new, longer structure would be located such that scour would not be a concern.

Historic Bridge Effects

No formal determination has been made as to whether the improvements described above would meet the *Secretary of the Interior's Standards for Rehabilitation*. However, it is anticipated that structural materials would be replaced in-kind and the integrity of the truss would be retained. Rivets would be replaced with round-headed bolts to retain visual similarity and sway bracing would be re-installed. In accordance with Attachment B of the Historic Bridge PA, the rehabilitation plans will be reviewed by SHPO to ensure compliance with the Secretary of Interior's Standards for Rehabilitation and to incorporate context sensitive design features, where practicable.

Based on coordination with SHPO, there is concern that relocation of the trusses would result in their immediate removal from the NRHP. There is also concern that, because the bridge is listed under Criterion A for its transportation significance in the settlement and development of Clay County, that its relocation to another county would make it ineligible for continued listing. SHPO has requested that INDOT initiate a request that the bridge also be considered under Criterion C based on its engineering significance as well as its continued listing during and following any relocation. INDOT is in the process of submitting such a request.

Right-of-Way

Each of the Alternative 5 options would require right-of-way, ranging from 7-16 acres. No relocations would be required. Details for each option are provided in the sections below.

Utilities

Each option would require the relocation of some utilities; details for each option are provided below. None of these relocations are anticipated to be complicated or excessively costly.

Maintenance of Traffic

Alternative 5A would require a full detour resulting in high user costs. Each of the other options would maintain traffic on SR 46 except for limited periods. Details for each option are provided in the sections below.

Environmental Issues

Environmental surveys, including the Waters of the U.S. Determination Report, are still in progress; therefore, this assessment is preliminary and qualitative. Each of the alternatives would result in minor to moderate impacts to environmental resources, but would not impact any

unique or exceptional resources for which mitigation is not possible. Additional information is provided in the sections below.

Cost

Estimated project costs (right-of-way, utilities, construction, and rehabilitation/relocation of the existing bridge) for the Alternative 5 options range from \$8.2 – 11.0 million. User costs associated with closures and detours range from \$80,000 to \$4.8 million, the latter associated with the 9-month closure required to construct Alternative 5A. Total estimated costs range from \$9.7 million to \$13.0 million.

Section 4(f) Evaluation

It would be possible to design and build each of the Alternative 5 options; therefore, **each is a feasible alternative.**

Each of the Alternative 5 options would construct a safe, reliable structure to carry all traffic in the SR 46 corridor, thus meeting the project's purpose and need. Under each, the existing bridge would be relocated to the Salt Creek Trail, where there is a strong demand for a pedestrian facility and the truss spans can be installed to meet all hydraulic requirements.

Impacts associated with each of the Alternative 5 options vary; however, none would be considered severe. Long-term operation and maintenance costs would be similar for each and, while construction and user costs vary, none are of an extraordinary magnitude. Based on this evaluation, **each is a prudent alternative.**

The Section 4(f) analysis for each alternative is summarized in Table 14.

The sections below provide additional details about each Alternative 5 option and provide the basis for the selection of the preliminary preferred alternative.

Alternative 5A – Bridge Replacement on Existing Alignment – Full Detour

Alternative 5A would replace the bridge over the Eel River utilizing the existing SR 46 alignment (Appendix A, Figure 10). The roadway would be closed throughout construction and all traffic detoured. To allow for the additional structure depth of a new bridge and to provide a minimum 2 feet of freeboard, the profile of the existing roadway would need to be raised approximately 8 feet. This would require reconstruction of SR 46 for approximately 800 feet to the west of the existing bridge and approximately 600 feet to the east in order to transition back to existing grade.

Accelerated Bridge Construction (ABC) techniques were investigated in an effort to minimize the duration of the closure. These methods include the use of prefabricated bridge elements or construction of the bridge offline and then sliding it into place. These techniques are typically applied when a structure is being replaced on its existing alignment and closures incur substantial impacts. At this location, both prefabricated elements and slide-in structures were considered. However, as noted earlier, the roadway profile at this location must be raised by 6-8 feet to accommodate the additional structure depth of a new bridge and provide adequate freeboard above the river. Additionally, any new bridge would need to be longer than the existing one, likely with a different span arrangement, to satisfy hydraulic requirements. While these techniques could be applied to the SR 46 bridge, they would be cost-prohibitive compared to alternative methods of maintaining traffic. As such, Alternative 5A did not include any of these techniques.

Compliance with Design Standards

The new bridge would be designed to meet 4R as defined in the *Indiana Design Manual* as shown in Table 10.

The new bridge would meet all applicable design criteria. The approach roadways would also meet all design criteria; however, it should be noted that the nonstandard grade on the approach to Bowling Green identified in other alternatives would exist under this alternative as well, but would lie outside the project limits and, therefore, not require a Level 1 design exception.

Right-of-Way

Alternative 5A would require approximately 7.0 acres of new right-of-way from 5 parcels to allow for the grading required to raise the roadway profile and the realignment of CR 475 E.

Utilities

Overhead utility lines parallel the roadway to the south. Alternative 5A would require the relocation of approximately 2 utility poles to allow for the realignment of CR 475 E.

Maintenance of Traffic

Alternative 5A would require the full closure of SR 46 for approximately 9 months. During this time, the posted detour would use SR 59 and SR 246 (see Appendix C, page 51), adding 7 miles to a through trip. This is the same detour route used during the closure in 2011. As noted previously, SR 246 is a narrow, winding rural roadway not well suited to large trucks, resulting in numerous complaints from the public when this was used as a detour route during the 2011 repair project.

TABLE 10 - DESIGN CRITERIA FOR ALTERNATIVE 5A

Design Element	Minimum Design Criteria	Existing Condition	Proposed Condition	Level 1 Design Exception Required
New Bridge Features ⁽¹⁾				
Travel Lane	12'	11'	12'	No
Shoulder	10'	1'	10'	No
Structural Capacity	HL-93	H-20	HL-93	No
Clear Roadway Width	44'	24'	44'	No
Vertical Clearance	16.5'	14'-8" ⁽²⁾	N/A ⁽³⁾	No
Pedestrian Bridge Features ⁽⁴⁾				
Structural Capacity	H-10	H-20	H-10	No
Roadway Features ⁽¹⁾				
Travel Lane	12'	11'	12'	No
Shoulder Width	10'	1'	10'	No
Stopping Sight Distance at Vertical Curve	570'	415'	588'	No
Maximum Grade	3%	3.7%	2.8%	No
Through Lane Cross Slope	2%	2%	2%	No

(1) *Indiana Design Manual*, Chapter 53 and Figure 53-2

(2) Vertical clearance has been achieved through the removal of the lower sway bracing.

(3) The new bridge will have no vertical obstructions.

(4) LRFD Guide Specifications for the Design of Pedestrian Bridges

Environmental Issues

Environmental surveys, including the Waters of the U.S. Determination Report, are still in progress; therefore, this assessment is preliminary and qualitative. Reconstruction work on the approaches to the bridge would potentially cause minor impacts to a stream located in the southeast quadrant of the bridge. The jurisdictional status of other water features in the area has not been determined. Minimal tree clearing may also be required. Impacts to Waters of the US would be mitigated as required through the Section 404/401 permitting process. Potential impacts to other resources, including threatened and endangered species and the Eel River floodway will be reported in the project’s CE document and mitigated as appropriate. This alternative would also result in traffic-related impacts on other communities along the alternative route(s) that vehicles utilized.

Cost

Alternative 5A would cost \$8,179,880 to construct and would have user costs, resulting from time and operating expenses associated with the longer, slower detour of \$4,848,363, for a total cost of \$13,028,243. Additional cost details are provided in Appendix C, pages 17-22 and pages 47-48.

Construction Cost*	\$8,029,880
ROW/Utilities	\$150,000
Project Cost	\$8,179,880
User Costs	\$4,848,363
TOTAL COST	\$13,028,243

*Includes rehabilitation and relocation of existing bridge, the new bridge, and roadway improvements

Alternative 5B-S – Bridge Replacement on Existing Alignment – Temporary Bridge to South

Alternative 5B-S would replace the bridge over the Eel River utilizing the existing SR 46 alignment (Appendix A, Figure 11). In order to maintain traffic during construction, a temporary bridge would be constructed to the south of the existing bridge. To allow for the additional structure depth of a new bridge and to provide a minimum 2 feet of freeboard, the profile of the existing roadway would need to be raised approximately 8 feet. This would require reconstruction of SR 46 for approximately 800 feet to the west of the existing bridge and approximately 600 feet to the east in order to transition back to existing grade.

The temporary bridge would be designed as a 6-span, 372-foot long, single lane structure with temporary signals on either end to control traffic flow. The temporary bridge would be constructed with a low structure elevation of 567.6. This elevation, equivalent to the Q₂ storm event (a storm that has a 50% chance of occurrence in any given year), would allow water to overtop the roadway and not create a backwater issue upstream. In the event of a storm greater than the Q₂ storm, the bridge would be closed to traffic. Throughout construction, the temporary bridge would need to be monitored for the accumulation of debris at the piers that could create scour concerns. The contractor would be required to remove debris immediately.

Compliance with Design Standards

The new bridge would be designed to meet 4R as defined in the *Indiana Design Manual* as shown in Table 11.

The new bridge would meet all applicable design criteria. The approach roadways would also meet all design criteria; however, it should be noted that the nonstandard grade identified in other alternatives would exist under this alternative as well, but would lie outside the project limits and, therefore, not require a Level 1 design exception.

Right-of-Way

Alternative 5B-S would require approximately 10.6 acres of new right-of-way from 5 parcels to allow for the construction of the temporary bridge, the grading required to raise the roadway profile, and the realignment of CR 475 E.

Utilities

Overhead utility lines parallel the roadway to the south. Alternative 5B-S would require the relocation of approximately 5 utility poles.

Maintenance of Traffic

As described above, a single-lane temporary bridge would be in place throughout construction, with temporary signals at either end controlling traffic. While vehicles would experience some delay associated with the signals, reduced speeds, and roadway curvature, SR 46 would remain open to all traffic.

TABLE 11 - DESIGN CRITERIA FOR ALTERNATIVE 5B-S

Design Element	Minimum Design Criteria	Existing Condition	Proposed Condition	Level 1 Design Exception Required
New Bridge Features ⁽¹⁾				
Travel Lane	12'	11'	12'	No
Shoulder	10'	1'	10'	No
Structural Capacity	HL-93	H-20	HL-93	No
Clear Roadway Width	44'	24'	44'	No
Vertical Clearance	16.5'	14'-8" ⁽²⁾	N/A ⁽³⁾	No
Pedestrian Bridge Features ⁽⁴⁾				
Structural Capacity	H-10	H-20	H-10	No
Roadway Features ⁽¹⁾				
Travel Lane	12'	11'	12'	No
Shoulder Width	10'	1'	10'	No
Stopping Sight Distance at Vertical Curve	570'	415'	588'	No
Maximum Grade	3%	3.7%	2.8%	No
Through Lane Cross Slope	2%	2%	2%	No

(1) *Indiana Design Manual*, Chapter 53 and Figure 53-2

(2) Vertical clearance has been achieved through the removal of the lower sway bracing.

(3) The new bridge will have no vertical obstructions.

(4) LRFD Guide Specifications for the Design of Pedestrian Bridges

Environmental Issues

Environmental surveys, including the Waters of the U.S. Determination Report, are still in progress; therefore, this assessment is preliminary and qualitative. Construction of the temporary bridge to the south would potentially cause moderate impacts to a stream located in the southeast quadrant of the bridge and would require moderate tree clearing. The jurisdictional status of other water features in the area has not been determined. Impacts to Waters of the US would be mitigated as required through the Section 404/401 permitting process. Potential impacts to other resources, including threatened and endangered species

and the Eel River floodway will be reported in the project’s CE document and mitigated as appropriate.

Cost

Alternative 5B-S would cost \$11,025,257 to construct and would have user costs, resulting from time and operating expenses associated with the construction zone of \$576,445, for a total cost of \$11,601,702. Additional cost details are provided in Appendix C, pages 23-28 and page 49. Note the user costs presented here do not include the costs associated the closure of the temporary bridge due to a large storm event. Depending on the magnitude and duration of the event the user cost could increase substantially.

Construction Cost*	\$10,814,257
ROW/Utilities	\$211,000
Project Cost	\$11,025,257
User Costs	\$576,445
TOTAL COST	\$11,601,702
*Includes rehabilitation and relocation of existing bridge, the new bridge, and roadway improvements	

Alternative 5B-N – Bridge Replacement on Existing Alignment – Temporary Bridge to North

Alternative 5B-N would be similar to Alternative 5B-S except that the temporary structure would be built to the north of the existing bridge (Appendix A, Figure 12). Only features that differ from Alternative 5B-S are described below.

Right-of-Way

Alternative 5B-N would require approximately 11.0 acres of new right-of-way from 5 parcels to allow for the construction of the temporary bridge, the grading required to raise the roadway profile, and the realignment of CR 475 E.

Utilities

Buried fiber optic lines parallel the roadway to the north. Alternative 5B-N would require the lines to be relocated. This alternative would also require the relocation of approximately 2 utility poles on the south side of the roadway in order to realign CR 475 E.

Environmental Issues

Environmental surveys, including the Waters of the U.S. Determination Report, are still in progress; therefore, this assessment is preliminary and qualitative. Reconstruction of the roadway approaches would potentially cause moderate impacts to a stream located in the southeast quadrant of the bridge and would require moderate tree clearing. Construction of the temporary bridge to the north would require additional tree clearing. The jurisdictional status of other water features in the area has not been determined. Impacts to Waters of the US would be mitigated as required through the Section 404/401 permitting process. Potential impacts to other resources, including threatened and endangered species and the Eel River floodway will be reported in the project’s CE document and mitigated as appropriate.

Cost

Alternative 5B-N would cost \$11,028,285 to construct and would have user costs, resulting from time and operating expenses associated with the construction zone of \$576,445, for a total cost of \$11,604,730. Additional cost details are provided in Appendix C, pages 29-34 and page 49. Note the user costs presented here do not include the costs associated the closure of the temporary bridge due to a large storm event. Depending on the magnitude and duration of the event the user cost could increase substantially.

Construction Cost*	\$10,828,285
ROW/Utilities	\$200,000
Project Cost	\$11,028,285
User Costs	\$576,445
TOTAL COST	\$11,604,730
*Includes rehabilitation and relocation of existing bridge, the new bridge, and roadway improvements	

Alternative 5C-S – Bridge Replacement on New Alignment to South (Preliminary Preferred Alternative)

Alternative 5C-S would construct a new bridge over the Eel River approximately 20 feet to the south of the existing bridge and permanently realign the SR 46 roadway (Appendix A, Figure 13). To allow for the additional structure depth of a new bridge and to provide a minimum 2 feet of freeboard, the profile of the existing roadway would need to be raised approximately 8 feet.

The alignment of SR 46 would need to be adapted to access this new structure. Starting about 0.5 mile west of the bridge, SR 46 would diverge to the south of the existing alignment and require a reverse curve formation in order to merge back into the existing roadway alignment approximately 0.25 mile east of the bridge.

Compliance with Design Standards

The new bridge would meet all applicable design criteria. The approach roadways would meet all design criteria, except for maximum grade at the eastern end of the project as the roadway approaches Bowling Green as shown in Table 12. The steep grade exists today and correcting it would be cost-prohibitive.

TABLE 12 - DESIGN CRITERIA FOR ALTERNATIVE 5C-S

Design Element	Minimum Design Criteria	Existing Condition	Proposed Condition	Level 1 Design Exception Required
Bridge Features ⁽¹⁾				
Travel Lane	12'	11'	12'	No
Shoulder	10'	1'	10'	No
Structural Capacity	HL-93	H-20	HL-93	No
Clear Roadway Width	44'	24'	44'	No
Vertical Clearance	16.5'	14'-8" ⁽²⁾	N/A ⁽³⁾	No
Pedestrian Bridge Features ⁽⁴⁾				
Structural Capacity	H-10	H-20	H-10	No
Roadway Features ⁽¹⁾				
Travel Lane	12'	11'	12'	No
Shoulder Width	10'	1'	10'	No
Stopping Sight Distance at Vertical Curve	570'	415'	588'	No
Maximum Grade	3%	6.74%	7.16%	Yes
Through Lane Cross Slope	2%	2%	2%	No

(1) *Indiana Design Manual*, Chapter 53 and Figure 53-2

(2) Vertical clearance has been achieved through the removal of the lower sway bracing.

(3) The new bridge will have no vertical obstructions.

(4) LRFD Guide Specifications for the Design of Pedestrian Bridges

Right-of-Way

Alternative 5C-S would require approximately 13.9 acres of new right-of-way from 7 parcels to allow for the construction of the bridge and the realignment of SR 46 and CR 475 E.

Utilities

Overhead utility lines parallel the roadway to the south. Alternative 5C-S would require the relocation of approximately 8 utility poles.

Maintenance of Traffic

During construction of the new bridge and approaches traffic would be maintained on the existing SR 46 roadway and bridge. No disruption to SR 46 traffic is anticipated except at the location where the new road is tied into the existing one. At no time is it anticipated that SR 46 would be completely closed to traffic.

Environmental Issues

Environmental surveys, including the Waters of the U.S. Determination Report, are still in progress; therefore, this assessment is preliminary and qualitative. Construction of the new bridge to the south would potentially cause moderate impacts to a stream located in the southeast quadrant of the bridge and would require moderate tree clearing. The jurisdictional status of other water features in the area has not been determined. Impacts to Waters of the US would be mitigated as required through the Section 404/401 permitting process. Potential impacts to other resources, including threatened and endangered species and the Eel River floodway will be reported in the project's CE document and mitigated as appropriate.

Cost

Alternative 5C-S would cost \$9,663,935 to construct and would have user costs, resulting from time and operating expenses associated with reduced speeds through the construction zone of \$81,081, for a total cost of \$9,745,016. Additional cost details are provided in Appendix C, pages 35-40 and page 50.

Construction Cost*	\$9,389,935
ROW/Utilities	\$274,000
Project Cost	\$9,663,935
User Costs	\$81,081
TOTAL COST	\$9,745,016
*Includes rehabilitation and relocation of existing bridge, the new bridge, and roadway improvements	

Alternative 5C-N – Bridge Replacement on New Alignment to North

Alternative 5C-N would be similar to Alternative 5C-S except that the new bridge would be built to the north of the existing bridge (Appendix A, Figure 14). Only features that differ from Alternative 5C-S are described below.

Compliance with Design Standards

Like Alternative 5C-S, this alternative would require a Level 1 design exception for maximum grade based on the grade approaching Bowling Green, as shown in Table 13. Alternative 5C-N would also require a Level 1 design exception for the curve radius in the same area. While a full sight distance analysis has not been completed, it is likely that sight distance would be further compromised due to the likely need to install guardrail on the inside of this curve. Flattening out this curve to make it standard would require acquisition of right-of-way from multiple residential parcels in Bowling Green.

Right-of-Way

Alternative 5C-N would require approximately 16.1 acres of new right-of-way from 13 parcels to allow for the construction of the bridge and the realignment of SR 46 and CR 475 E. It is also likely that this alternative would require the relocation of one residence in Bowling Green.

Utilities

Buried fiber optic lines parallel the roadway to the north. Alternative 5B-N would require the lines to be relocated. This alternative would also require the relocation of approximately 2 utility poles in order to realign CR 475 E.

Environmental Issues

Environmental surveys, including the Waters of the U.S. Determination Report, are still in progress; therefore, this assessment is preliminary and qualitative. Construction of the new bridge to the north would require moderate tree clearing. The jurisdictional status of water features in the area has not been determined. Impacts to Waters of the US would be mitigated as required through the Section 404/401 permitting process. Potential impacts to other resources, including threatened and endangered species and the Eel River floodway will be reported in the project’s CE document and mitigated as appropriate.

TABLE 13 - DESIGN CRITERIA FOR ALTERNATIVE 5C-N

Design Element	Minimum Design Criteria	Existing Condition	Proposed Condition	Level 1 Design Exception Required
Bridge Features ⁽¹⁾				
Travel Lane	12'	11'	12'	No
Shoulder	10'	1'	10'	No
Structural Capacity	HL-93	H-20	HL-93	No
Clear Roadway Width	44'	24'	44'	No
Vertical Clearance	16.5'	14'-8" ⁽²⁾	N/A ⁽³⁾	No
Pedestrian Bridge Features ⁽⁴⁾				
Structural Capacity	H-10	H-20	H-10	No
Roadway Features ⁽¹⁾				
Travel Lane	12'	11'	12'	No
Shoulder Width	10'	1'	10'	No
Horizontal Curvature	1200'	1,432'	1000'	Yes
Stopping Sight Distance at Vertical Curve	570'	415'	588'	No
Maximum Grade	3%	6.74%	7.36%	Yes
Through Lane Cross Slope	2%	2%	2%	No

(1) *Indiana Design Manual*, Chapter 53 and Figure 53-2

(2) Vertical clearance has been achieved through the removal of the lower sway bracing.

(3) The new bridge will have no vertical obstructions.

(4) LRFD Guide Specifications for the Design of Pedestrian Bridges

Cost

Alternative 5C-N would cost \$10,015,307 to construct and would have user costs, resulting from time and operating expenses associated with reduced speeds through the construction zone of \$81,081, for a total cost of \$10,096,388. Additional cost details are provided in Appendix C, pages 41-46 and page 50.

Construction Cost*	\$9,458,840
ROW/Utilities	\$371,000
Project Cost	\$10,015,307
User Costs	\$81,081
TOTAL COST	\$10,096,388
*Includes rehabilitation and relocation of existing bridge, the new bridge, and roadway improvements	

Alternatives Evaluation

While the project cost of Alternative 5A is the lowest of these options, it would cause substantial user costs (\$4.8 million) as a result of the closure of SR 46 for approximately 9 months. Based on the response to the previous closures, both of which were much shorter, INDOT has determined that this alternative is not in the interest of the traveling public and eliminated it from consideration.

Alternatives 5B-N and 5B-S would each utilize a temporary bridge and signal to construct a new bridge on the existing alignment. Either alternative would reduce the user costs compared to Alternative 5A, with only a couple short term closures required. However, the temporary bridge's low elevation would introduce a risk that it would be overtopped requiring additional closures. Finally, these options would cost more than \$1 million more than Alternative 5C-S or 5C-N.

Alternatives 5C-N and 5C-S would each maintain traffic on the existing bridge and roadway throughout construction, minimizing user costs associated with delay or detours. Project costs are similar for each, as are environmental and right-of-way impacts. Both would require a Level 1 design exception for the maximum grade approaching Bowling Green; Alternative 5C-N, would introduce a horizontal curve on its approach to Bowling Green that would require an additional Level 1 design exception. Eliminating this non-standard curve would require impacts to several residential properties.

Based on the analysis above, INDOT has identified Alternative 5C-S as the preliminary preferred alternative. A comparison of all alternatives is provided in Table 14.

VI. MINIMIZATION AND MITIGATION

In addition to evaluating if there is a feasible and prudent avoidance alternative, minimization and mitigation of unavoidable impacts to the historic resource is required.

A. Minimization

As noted above, no formal determination has been made as to whether the rehabilitation of the existing bridge described above would meet the *Secretary of the Interior's Standards for Rehabilitation*. However, it is anticipated that structural materials would be replaced in-kind and the integrity of the truss would be retained. Rivets would be replaced with round-headed bolts to retain visual similarity and sway bracing would be re-installed, as it would meet the 10 foot minimum clearance for a shared use path. In accordance with Attachment B of the Historic Bridge PA, the rehabilitation plans will be reviewed by SHPO to ensure compliance with the Secretary of Interior's Standards for Rehabilitation and to incorporate context sensitive design features, where practicable.

B. Mitigation

INDOT will consult with the SHPO to determine if photo documentation of the existing bridge is needed. Any requirement for documentation will be included in the Section 106 Findings documentation. INDOT will work with IDNR to determine if interpretive signage regarding the bridge's history and origin could be provided nearby.

VII. PRELIMINARY PREFERRED ALTERNATIVE

As noted above, Alternative 5C-S was found to be both feasible and prudent and has been identified as the preliminary preferred alternative.

TABLE 14: ALTERNATIVES ANALYSIS SUMMARY

Alternative	Meets Project Purpose & Need	Project Cost	User Cost	Total Cost	Feasible & Prudent
1	No Build	N/A*	\$6,482,243 per year of closure*	N/A*	Feasible: Yes Prudent: No – Does not meet purpose and need; cost associated with road closure
2	Rehabilitation for Continued Vehicular Use	\$4,838,780	\$4,848,363	\$9,687,143	Feasible: No – Cannot be rehabilitated to meet current design standards Prudent: No – Non-standard features, hydraulics, user costs
3	Rehabilitation for Continued Vehicular Use/ One-Way Pair	\$11,349,048	\$81,081	\$11,430,129	Feasible: No – Cannot be rehabilitated to meet current design standards Prudent: No – Non-standard features, hydraulics
4	Bypass/Non-Vehicular Use	\$10,260,836	\$81,081	\$10,341,917	Feasible: Yes Prudent: No – Pedestrian bridge hydraulics; very low pedestrian usage
5A	Bridge Replacement on Existing Alignment – Full Detour	\$8,179,880	\$4,848,363	\$13,028,243	Feasible: Yes Prudent: Yes
5B-S	Bridge Replacement on Existing Alignment – Temporary Bridge to South	\$11,025,257	\$576,445	\$11,601,702	
5B-N	Bridge Replacement on Existing Alignment – Temporary Bridge to North	\$11,028,285	\$576,445	\$11,604,730	
5C-S	Bridge Replacement on New Alignment to South (Preliminary Preferred Alternative)	\$9,663,935	\$81,081	\$9,745,016	
5C-N	Bridge Replacement on New Alignment to North	\$10,015,307	\$81,081	\$10,096,388	

* While the No Build Alternative does not include any improvements, it is not possible to estimate the costs associated with any repairs that would be required or the user costs associated with any temporary or permanent closures.

Appendix B

Photographs & Maps of the Bridge in its Existing Location



SR 46 Bridge over Eel River
 Bridge Number: 046-11-01316D

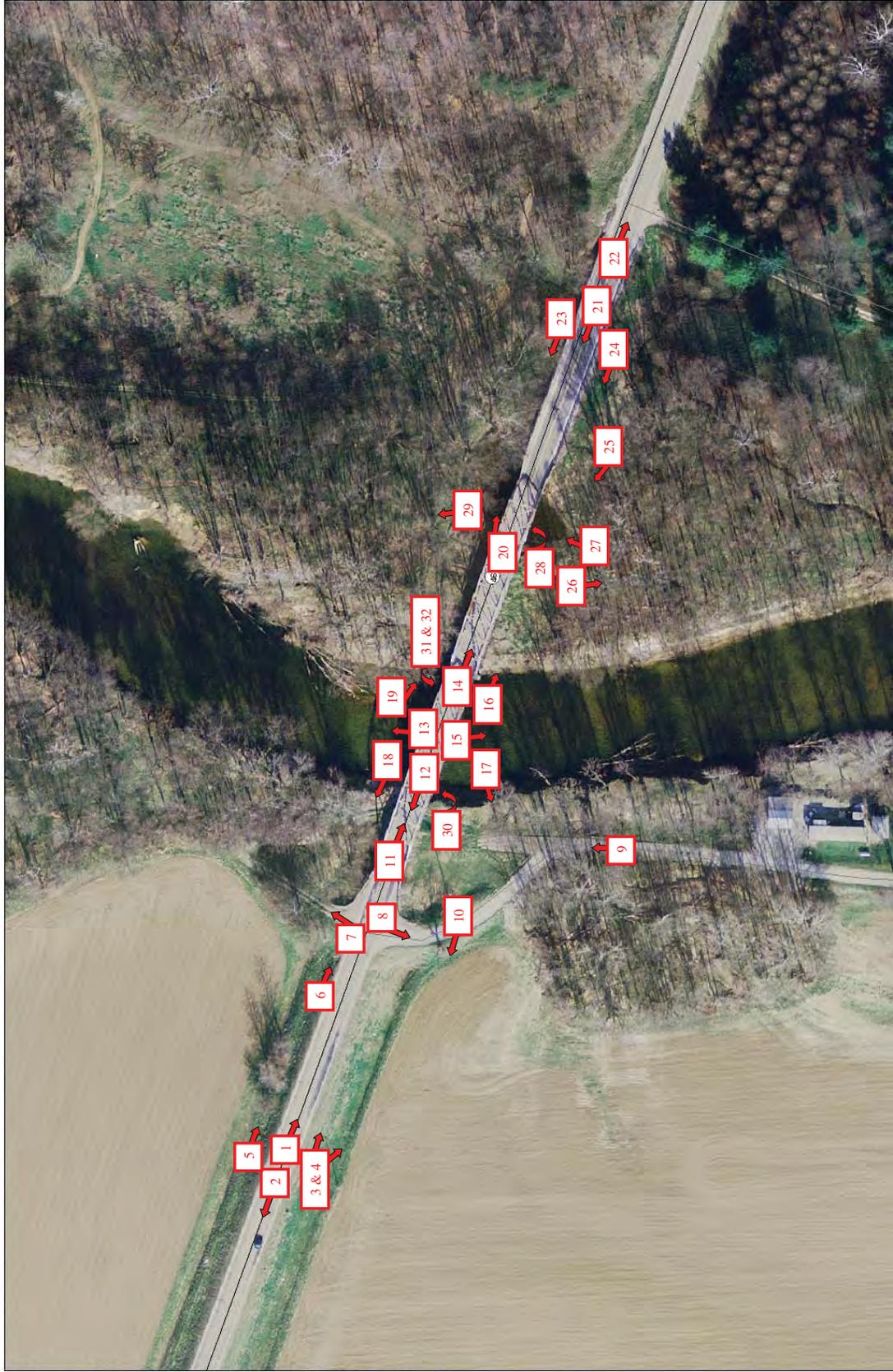
Image: USGS, Center Point quad
 Data: USFWS, National Wetlands Inventory

Legend

- NWI Polygons



DES: 0800910
S.R. 46 Bridge Project over Eel River; 4.84 Miles East of S.R. 59; Clay County
Project Area Photographs; Photograph Location Map



Des: 0800910

SR 46 Bridge Project (Bridge # 046-11-01316A) over the Eel River; 4.84 Miles East of S.R. 59
Near Bowling Green, in Washington Township, in Clay County, Indiana
Project Area Photographs



Photo 1: Standing on SR 46 facing east towards the bridge (Bridge # 046-11-01316A).



Photo 2: Standing on SR 46 facing west.



Photo 3: View (1) of the SW ditch.



Photo 4: View (2) of the SW ditch and farmland where CR 475 E will be relocated.

Des: 0800910
SR 46 Bridge Project (Bridge # 046-11-01316A) over the Eel River; 4.84 Miles East of S.R. 59
Near Bowling Green, in Washington Township, in Clay County, Indiana
Project Area Photographs



Photo 5: View of the NW shoulder.



Photo 6: View of the farm filed entrance adjacent from CR 475 E.



Photo 7: Looking north at the farm field entrance intersection with SR 46.

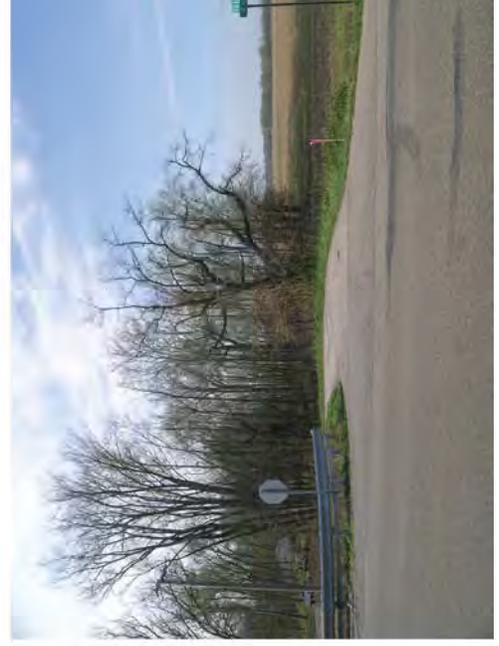


Photo 8: Looking south at the SR 46/CR 475 E intersection.

Des: 0800910

SR 46 Bridge Project (Bridge # 046-11-01316A) over the Eel River; 4.84 Miles East of S.R. 59
Near Bowling Green, in Washington Township, in Clay County, Indiana
Project Area Photographs



Photo 9: Standing on CR 475 E looking north.



Photo 10: Standing on CR 475 looking west to where CR 475 E will be relocated.



Photo 11: Standing on SR 46 looking east at the bridge.



Photo 12: Standing on the bridge looking west.

Des: 0800910

SR 46 Bridge Project (Bridge # 046-11-01316A) over the Eel River; 4.84 Miles East of S.R. 59
Near Bowling Green, in Washington Township, in Clay County, Indiana
Project Area Photographs



Photo 13: Standing on the bridge looking north (upstream) at the Eel River.



Photo 14: Standing on the bridge looking east.



Photo 15: Standing on the bridge looking south (downstream) at the Eel River.



Photo 16: View of the SE bank.

Des: 0800910

SR 46 Bridge Project (Bridge # 046-11-01316A) over the Eel River; 4.84 Miles East of S.R. 59
Near Bowling Green, in Washington Township, in Clay County, Indiana
Project Area Photographs



Photo 17: View of the SW bank.



Photo 18: View of the NW bank.



Photo 19: View of the NE bank.

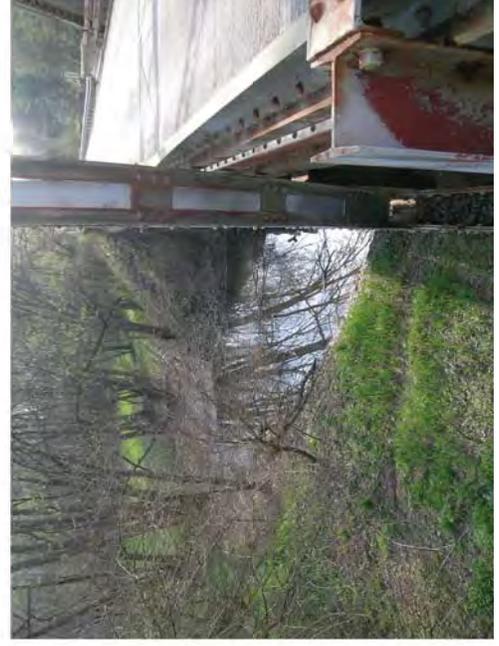


Photo 20: Looking at a ponded area near the eastern abutment.

Des: 0800910

SR 46 Bridge Project (Bridge # 046-11-01316A) over the Eel River; 4.84 Miles East of S.R. 59
Near Bowling Green, in Washington Township, in Clay County, Indiana
Project Area Photographs



Photo 21: Standing on SR 46 facing west towards the bridge.



Photo 22: Standing on SR 46 facing east.



Photo 23: View of the NE shoulder.



Photo 24: View of the SE shoulder.

Des: 0800910

SR 46 Bridge Project (Bridge # 046-11-01316A) over the Eel River; 4.84 Miles East of S.R. 59
Near Bowling Green, in Washington Township, in Clay County, Indiana
Project Area Photographs



Photo 25: Standing in the floodplain, looking northwest at the bridge.



Photo 26: Looking south at the floodplain.



Photo 27: Looking north at the floodplain and ponded area adjacent to the eastern abutment.



Photo 28: View (2) of the ponded area.

Des: 0800910

SR 46 Bridge Project (Bridge # 046-11-01316A) over the Eel River; 4.84 Miles East of S.R. 59
Near Bowling Green, in Washington Township, in Clay County, Indiana
Project Area Photographs



Photo 29: Looking north at the floodplain.



Photo 30: View of the western bank of the Eel River under the bridge.



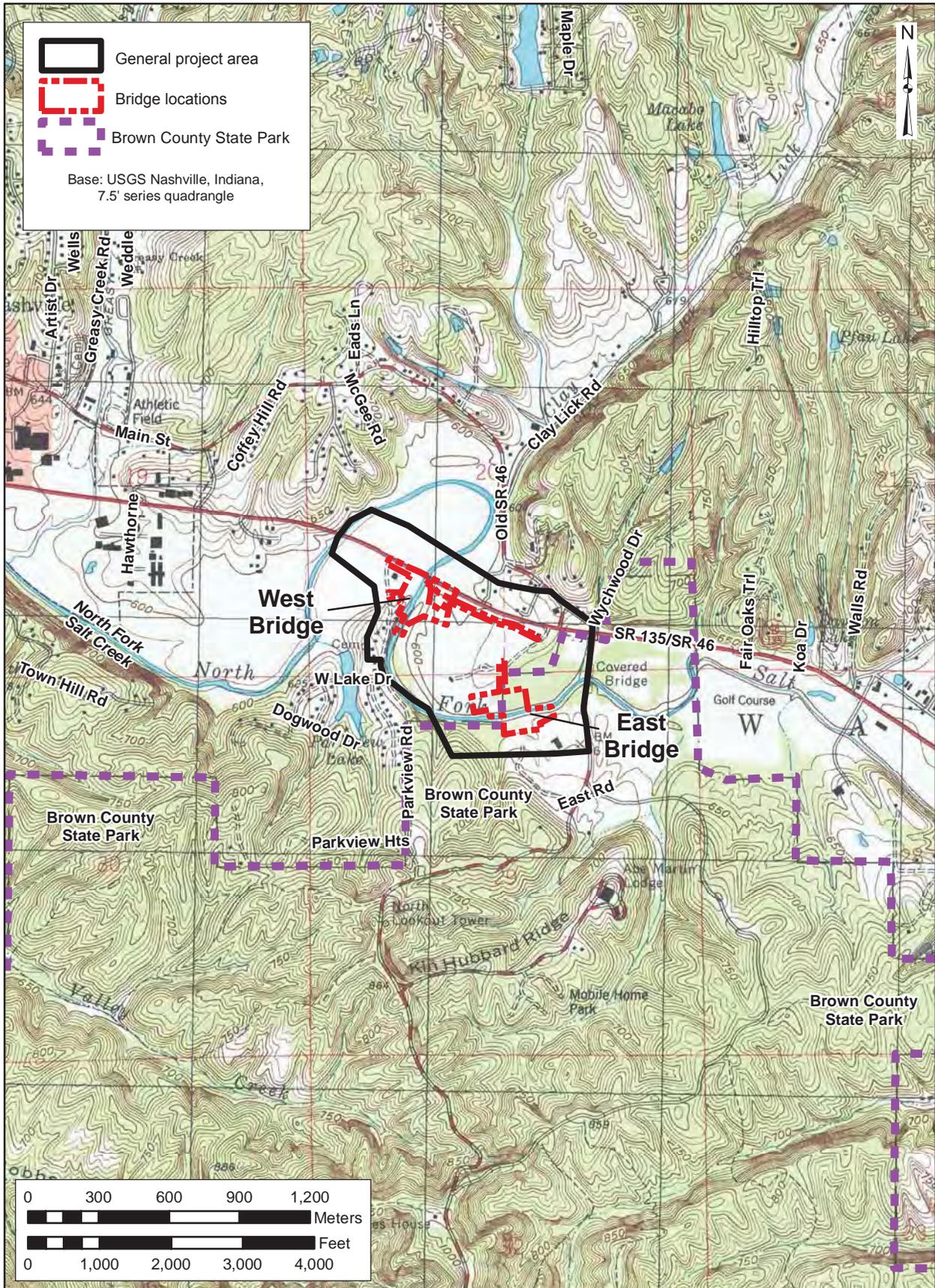
Photo 31: View of the NE bank of the Eel River under the bridge.



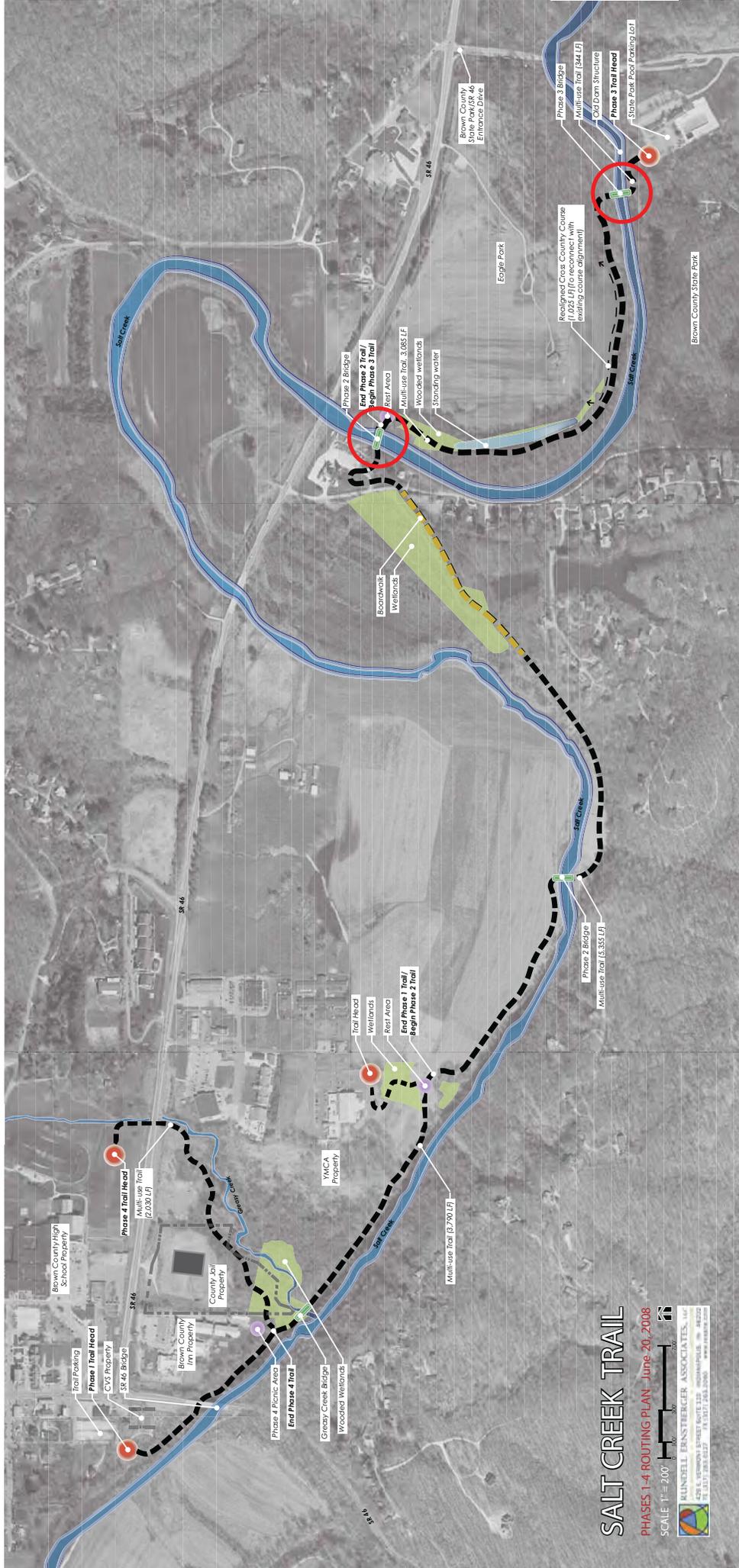
Photo 32: View of the SE bank of the Eel River under the bridge.

Appendix C

Photographs & Maps of the Proposed New Location



Portion of the 1998 Nashville, Indiana quadrangle (USGS 7.5' topographic map) showing the APE and project area.



Proposed location of Relocated Eel River Bridge Span



Legend

 Preliminary Construction Limits

 Salt Creek photo locations

0 50 100 200
 Feet

**Historic Bridge Relocation to Salt Creek Trail
Photo Location Map, West Bridge**



PARSONS



Photo 1: West bridge looking east from near west abutment.



Photo 2: West bridge looking south just north of west abutment.



Photo 3: West Bridge looking north from west abutment.



Photo 4: West bridge looking north (downstream).



Photo 5: West bridge looking south (upstream) from 100 feet downstream (north) of location.



Photo 6: West bridge looking west from east bank at area of west abutment.



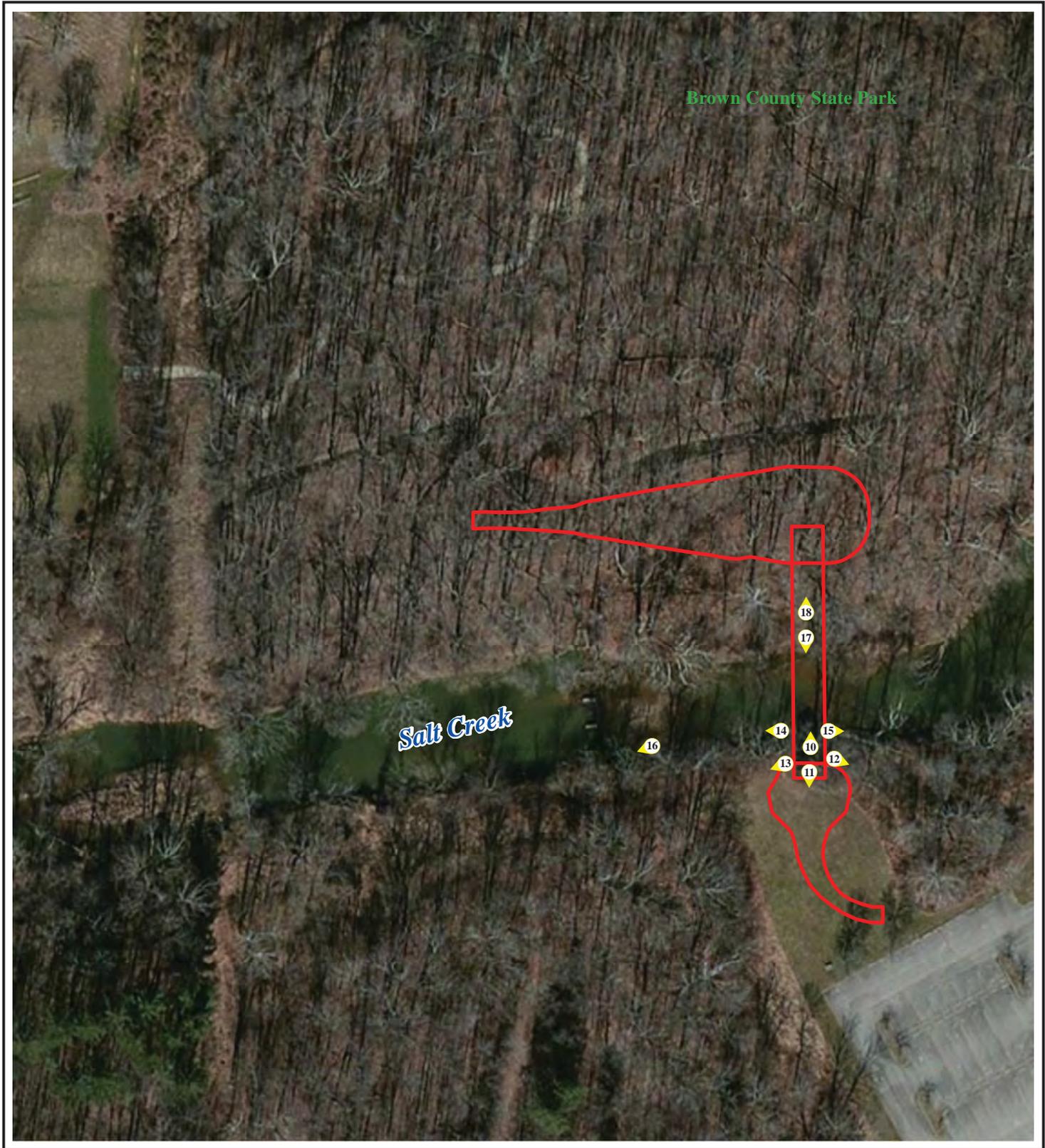
Photo 7: West bridge looking south from east bank.



Photo: 8 West bridge looking north from east bank.



Photo 9: West bridge looking south from east abutment.



Historic Bridge Relocation to Salt Creek Trail Photo Location Map, East Bridge

Legend

 Preliminary Construction Limits

 Salt Creek photo locations





Photo 10: East bridge looking north from south bank



Photo 11: East bridge looking south from south bank



Photo 12: East bridge looking east from south bank



Photo 13: East bridge looking west from south bank



Photo 14: East bridge looking downstream (west) at old dam



Photo 15: East bridge looking upstream (east)



Photo 16: East bridge looking downstream (southwest) at south bank bluff and old dam



Photo 17: East bridge looking south at south bank from north bank



Photo 18: East bridge looking north from north bank